DOCUMENT RESUME

ED 218 431 CE 031 221

AUTHOR Bacon, E. Miles
TITLE Engine Tune-up Service. Unit 6: Emission Control Systems. Review Exercise Book. Automotive Mechanics Curriculum.
INSTITUTION Florida State Univ., Tallahassee. Career Education Center.
SPONS AGENCY Florida State Dept. of Education, Tallahassee. Div. of Vocational Education.
PUB DATE Mar 78
NOTE 120p.; For related documents see CE 031 208-222 and CE 033 108-109.

EDRS PRICE MF01/PC05 Plus Postage.
DESCRIPTORS *Auto Mechanics; Check Lists; *Engines; Evaluation Criteria; Postsecondary Education; Pretests Posttests; Review (Reexamination); Secondary Education; Study Guides; *Trade and Industrial Education
IDENTIFIERS *Automotive Tune Up; Emission Control; *Emission Control Systems

ABSTRACT

This book of pretests and review exercises is designed to accompany the Engine Tune-Up Service Student Guide for Unit 6, Emission Control Systems, available separately as CE 031 220. Focus of the exercises and pretests is inspecting, testing, and servicing emission control systems. Pretests and performance checklists are provided for each of the seven performance objectives contained in the unit. There are 23 review exercises that are short check-ups to let the student know how well she/he has learned the material for one or more work activities covered in the Student Guide. Answers to all of the exercises are found at the back of the book. (YLB)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED218431

ENGINE TUNE-UP SERVICE

Unit 6: Emission Control Systems

Review Exercise Book

Automotive Mechanics Curriculum

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

David McOuat

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

CE 031 221

State of Florida
DEPARTMENT OF EDUCATION
Ralph D. Turlington, Commissioner of Education
Tallahassee, Florida

An equal opportunity employer • *Division of Vocational Education* • March, 1978

Written by: E. Miles Bacon

THE AUTOMOTIVE MECHANICS CURRICULUM TEAM

Team Leader: Roger L. Richardson
Instructional Designers: Ludy Goodson, Roger L. Richardson
Measurement and Evaluation Specialist: David Morse
Automotive Mechanics Curriculum Design Specialist: E. Miles Bacon
Subject Matter Specialist: Theodore R. May
Editors: Kathleen Lyons, Marie Foster
Graphic Designer: John S. Matlock
Research Librarian: Marsha T. Paddock

CAREER EDUCATION CENTER, FLORIDA STATE UNIVERSITY

Director: Robert L. Lathrop
Information Services Division Coordinator: Margaret Winkler
Production Division Coordinator: Mary Anne Kidd
Editorial Division Coordinator: Dolores Filson
Visual Communications Division Coordinator: Lynn Rogers
Diffusion and Dissemination Coordinator: Mary K. Price
Art Director: William J. Kidd

PRODUCTION

Proofreading and Traffic Supervisor: Ann Vente
Proofreaders: Alice Lawyer, Susan Fleming, Sam Harrison, Becky Goff
Copy Staff: Betty Willard, Agnes Padgett, Sylvia Finkell
Art Production Supervisor: Bob Burgun
Production Assistants: Hollis Bliss, Dan Haskin
Illustrators: Julian Key, Cheryll McMahon Frank, Robert Swanson

HOW TO USE THIS BOOK

In this Review Exercise Book, you'll find pretests and review exercises. These tests and exercises cover the material in the Student Guide. The Student Guide will tell you when to do a review exercise, so don't start doing any of these exercises just yet.

PRETESTS

You will take the pretest for Performance Objective 33 before you start working through the Student Guide. A pretest is a test designed to help you and your instructor find out what you already know. The questions on the pretest may also be used to help you review what you've learned after studying the material and doing the activities.

REVIEW EXERCISES

A review exercise is a short checkup that lets you know how well you've learned the material for one or more work activities covered in the Student Guide. It is a way of testing yourself. The answers to all the exercises are in the back of this book.

You might be tempted to turn to the answers before you complete the questions, but if you do, you'll be the loser—for two reasons. In the first place, automotive mechanics is a skilled and dangerous trade. You need to know what you're doing and how to do it safely without having to check the book on every step. If you don't learn the material well, you can hurt yourself or damage the vehicle. In the second place, you'll eventually be graded by your instructor on how well you can do a performance objective. So if you look at the answers first, you'll just be wasting your time.

After you answer all the questions in a review exercise, check your answers against the ones in the back of the book. Review the material in the Student Guide for any question you have trouble with. Talk with your instructor if you're still unsure about any of the material covered in the Student Guide.

FINAL TESTS

These are the only two tests on which you'll be graded. One of the tests will be a written test, and the other one will be a performance test. If you've studied the material in the Student Guide, and if you've done the exercises and work activities as required, you'll have no trouble doing well on these final tests. You may even find them easy and fun to complete.

Now turn to the next page and complete the pretest for Performance Objective 33.

PRETEST—P.O. 33: PCV

NAME _____

1. Place a check (✓) beside all the safety practices listed below that you should follow.
   _____ a. Use fender covers when working under the hood.
   _____ b. Keep long hair under a hat.
   _____ c. Wear extra-loose clothing for ease of movement.
   _____ d. Avoid reaching into the engine compartment without looking.

2. The positive crankcase ventilation (PCV) system is designed to:
   _____ a. provide additional air-fuel mixture to the engine when the engine is cold, for smoother operation.
   _____ b. recirculate unburned air-fuel mixture from the engine to the intake manifold.
   _____ c. automatically lean the air-fuel mixture at high engine speeds for best fuel economy
   _____ d. reduce the heat produced in the engine by circulating fresh air through the crankcase

3. For each part of the PCV system listed below, write the letter for the location of the part in the blank beside the name of the part.

PCV Parts	Locations
_____ 1. PCV valve	a. on top of the engine valve cover
_____ 2. two-way flow hose	b. inside the carburetor air cleaner assembly
_____ 3. crankcase inlet air filter	c. between the air cleaner assembly and the oil filler cap
_____ 4. PCV filter element	d. between the rocker arm cover and the intake manifold
	e. between the carburetor and the intake manifold
	f. between the carburetor air cleaner assembly and the exhaust manifold

4. What should happen when you shake a good PCV valve back and forth?
   _____ a. There should be no rattles or clicks.
   _____ b. There should be a rattling or clicking sound.
   _____ c. The PCV spring should slowly appear from the valve.

5. The PCV valve allows minimum air flow when the engine:
   _____ a. is not operating
   _____ b. is operating at idle speed
   _____ c. is operating at low speed
   _____ d. is operating at high speed

6. Place a check (✓) beside all the statements below that are true for testing the PCV system by the hand method.
   _____ a. The engine speed should be set at about 2000 RPM.
   _____ b. The PCV valve is removed from the engine.
   _____ c. A good PCV valve will not make any rattling, hissing, or clicking noises.
   _____ d. A good PCV valve should have a strong vacuum at the inlet.
   _____ e. A stiff piece of paper should be quickly blown away from the rocker arm cover at the oil filler hole.

7. When you are testing a PCV system by the tachometer method, which of these results indicates a bad PCV system?

_____ a. a drop in engine idle speed of 75–100 RPM
_____ b. no drop in engine idle speed

8. When you are testing a PCV system with a PCV tester, the tester should be placed:

_____ a. at the PCV valve inlet
_____ b. at the oil filler cap hole
_____ c. at the intake manifold inlet
_____ d. at the carburetor air cleaner inlet
_____ e. at the two-way flow hose

9. Which of these conditions requires replacement of the PCV hose?

_____ a. kinked hose
_____ b. hose filled with sludge
_____ c. a and b

10. Which of these solutions would be best for cleaning PCV system hoses?

_____ a. carburetor cleaner
_____ b. combustion chamber conditioner
_____ c. kerosene
_____ d. diluted Number 2 diesel fuel
_____ e. mild soap and water solution

11. What is the proper way to clean a carburetor inlet passage?

_____ a. Remove the carburetor and soak it in cleaning solvent.
_____ b. Turn a drill bit by hand through the opening.
_____ c. Scrape the opening clean with a screwdriver blade.

12. Place a check (✓) beside all the statements below that are true for servicing the crankcase inlet filter.

_____ a. The filter should be replaced every 12,000 miles.
_____ b. Before installing the filter, it should be soaked with 30-weight motor oil.
_____ c. When cleaning the filter, use only clean water to soak the filter.
_____ d. The filter should be cleaned when the PCV hoses are cleaned.

13. Dirty or clogged PCV valves should be:

_____ a. cleaned and reinstalled
_____ b. replaced

14. The steps listed below for removing and replacing a PCV valve are out of order. Write the letter of each step in the blank beside the proper number to show the correct sequence.

Order	Steps
_____ 1.	a. Test the operation of the PCV system.
_____ 2.	b. Loosen the PCV valve hose and remove the valve from the hose.
_____ 3.	c. Insert the PCV valve in the PCV hose.
_____ 4.	d. Remove the PCV valve from the engine rocker arm cover.
_____ 5.	e. Tighten any hose clamps and install the PCV valve into the mounting on the engine rocker arm cover.
_____ 6.	f. Check the PCV valve to be sure it is the correct model for the vehicle.

15. What could happen if the PCV valve were installed backwards?

_____ a. The engine idle speed would increase.
_____ b. Engine oil consumption would decrease.
_____ c. An explosion might occur if the engine backfired.
_____ d. The amount of blowby gases produced by the engine would increase.

When you finish this pretest, carefully tear it out of the book and give it to your instructor. After s(he) has checked your answers, your instructor will direct you to either practice the work activities or to study the material covered by this test.

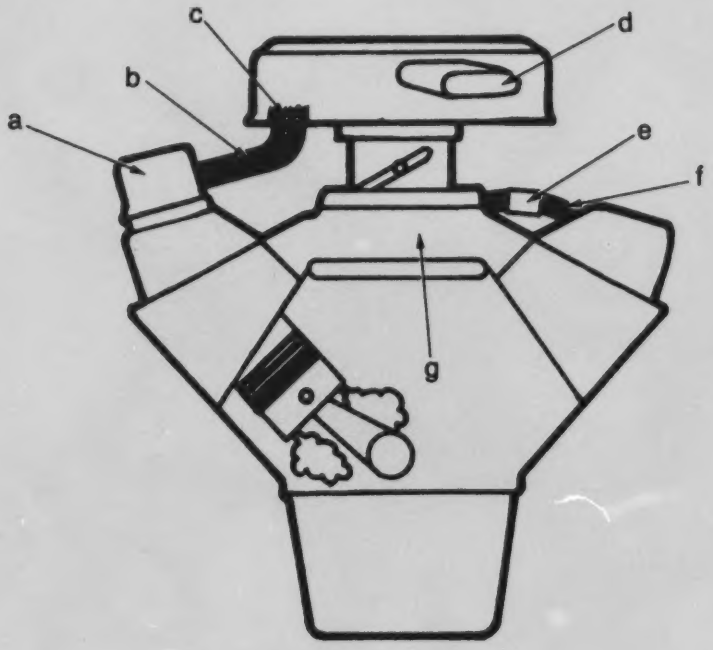
EXERCISE 1

1. Why should you always store carburetor air cleaner covers and filter elements in a safe place?

_____

_____

2. Identify the parts of a positive crankcase ventilation (PCV) system indicated in the illustration below.



a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

g. _____

3. The purpose of a positive crankcase ventilation system on a vehicle is to:

_____ a. provide the engine with leaner air-fuel mixtures
_____ b. store fuel vapors from fuel tanks in the crankcase
_____ c. regulate fuel flow to the carburetor
_____ d. direct blowby gases from the crankcase to the intake manifold and the engine for reburning

4. Inspection of a positive crankcase ventilation system covers the following parts (check each correct answer):

_____ a. engine oil filter
_____ b. PCV control valve
_____ c. PCV filter
_____ d. PCV hoses

5. During engine operation, the crankcase fumes, blowby gases, and condensation vapors are directed to the:

_____ a. oil filler cap
_____ b. crankcase inlet air cleaner
_____ c. carburetor air cleaner
_____ d. intake manifold

6. The purpose of the PCV valve is to:

_____ a. meter the mixture of harmful gases into the intake manifold
_____ b. separate dirt and contaminants from the crankcase vapors
_____ c. circulate fresh air through the crankcase
_____ d. regulate fuel flow to the carburetor

7. To inspect a PCV valve:

_____ a. check the tightness of the PCV valve in the engine rocker cover
_____ b. remove the PCV valve, shake it, and listen for a metallic clicking noise
_____ c. start the engine and squeeze the PCV hose to the air cleaner
_____ d. blow against the valve with compressed air

8. Complete each statement. To test the PCV system by hand, you would do the following:

   a. Operate the engine at _____ at normal engine _____ temperature.

   b. After step a, remove the PCV valve from the engine _____ .

   c. After step b, a _____ should be heard as air passes through the valve.

   d. After step c, place your finger over the _____ ; you should feel a strong _____ .

   e. After step d, reinstall the PCV valve, remove the oil filler cap, and loosely hold a piece of stiff _____ at the _____ in a rocker cover.

   f. After step e, the paper should be _____ against the opening with some force.

9. Complete each statement. To test the PCV system by the tachometer method, you would do the following:

   a. Operate the engine at _____ at normal engine _____ temperature.

   b. After step a, attach a tachometer to the engine, and then _____ the PCV valve hose off to _____ all air flow.

   c. After step b, know that the PCV system is functioning properly if the idle speed drops approximately _____ RPM or more.

Now turn to the back of this book and check your answers for Exercise 1.

EXERCISE 2

1. Most vehicle manufacturers recommend that the positive crankcase ventilation system be inspected, tested, and serviced:

   _____ a. every 12 months
   _____ b. every 6 months
   _____ c. every 5,000 miles
   _____ d. every 3 years

2. Most PCV hoses are cleaned with:

   _____ a. parts cleaner solvent
   _____ b. kerosene
   _____ c. combustion chamber conditioner or a similar solvent
   _____ d. soap and water

3. When cleaning PCV hoses, they should not remain in the cleaning solvent more than:

   _____ a. 1 hour
   _____ b. 1/2 hour
   _____ c. 2 hours

4. To clean the carburetor inlet passage of the PCV system, remove the carburetor and:

   _____ a. blow the particles out of the passage with compressed air
   _____ b. use a drill smaller in size than the passage and turn it by hand to remove the particles
   _____ c. soak the carburetor in carburetor cleaner solvent
   _____ d. remove the passage and wipe it clean of particles

5. Complete each statement. To service a crankcase inlet filter, you should do the following:

   a. Remove the inlet filter from the vehicle and wash it thoroughly in

      _____ _____ .

   b. After step a, _____ _____

      the filter by turning it upside down and filling it with Number_____ _____ .

   c. After step b, allow excess oil to drain thoroughly from the _____ .

   d. After step c, reinstall the crankcase inlet filter on the engine_____ _____ .

6. Check each correct answer. When replacing PCV valves, there are two principal precautions you must follow:

   _____ a. Be sure the correct PCV valve is installed in the engine.
   _____ b. Be sure the engine is not operating when you replace the PCV valve.
   _____ c. Be sure the PCV valve is in the correct position when installed in the PCV system.
   _____ d. Be sure the PCV system is plugged when the hoses are disconnected.

Now turn to the back of this book and check your answers for Exercise 2

PERFORMANCE CHECKLIST—P.O. 33

Your instructor will provide either a live vehicle or live engine for this objective. Perform an operational inspection of a PCV system and correct any problems. All of the performances below must be accomplished.

Student Performances	Instructor Ratings		
	Acceptable	Not Acceptable	Omit
1. Visually inspects PCV system parts, correcting defects as necessary.			
2. Operationally tests PCV system, following manufacturer's procedures.			
3. Cleans or replaces PCV system parts as necessary.			
4. Rechecks PCV system operation.			
5. Uses proper tools and equipment.			
6. Follows all appropriate safety precautions.			
7. Time.			

Keep a copy of this checklist for your records.

PRETEST—P.O. 34: FUEL EVAPORATIVE EMISSION CONTROL SYSTEMS

NAME _____

1. Place a check (✓) beside all the safety practices listed below that you should follow.
   - _____ a. Place hydraulic jacks securely under the vehicle frame before lifting.
   - _____ b. Wear eye protection when working under a vehicle.
   - _____ c. Keep jack handles on the floor when not in use.
   - _____ d. Check the rated capacity of the hydraulic lift equipment before raising a vehicle.
   - _____ e. Avoid sparks or flames when servicing fuel evaporative emission control systems.
   - _____ f. Use fender covers to protect the fenders only when you are wearing a belt.

2. To service charcoal canisters, you should:
   - _____ a. clamp the vapor vent lines before removing them
   - _____ b. plug the vapor vent lines after removing them
   - _____ c. leave the vapor vent lines open after removing them

3. What is the purpose of the fuel evaporative emission control system?
   - _____ a. The system provides an additional amount of fuel vapors to the engine for faster starting.
   - _____ b. The system allows excess fuel vapors to be released in the atmosphere so the engine can produce fewer emissions.
   - _____ c. The system vaporizes the fuel before it reaches the carburetor so engine performance is smoother.
   - _____ d. The system prevents fuel vapors from the fuel tank and carburetor from escaping in the atmosphere when the engine is not operating.

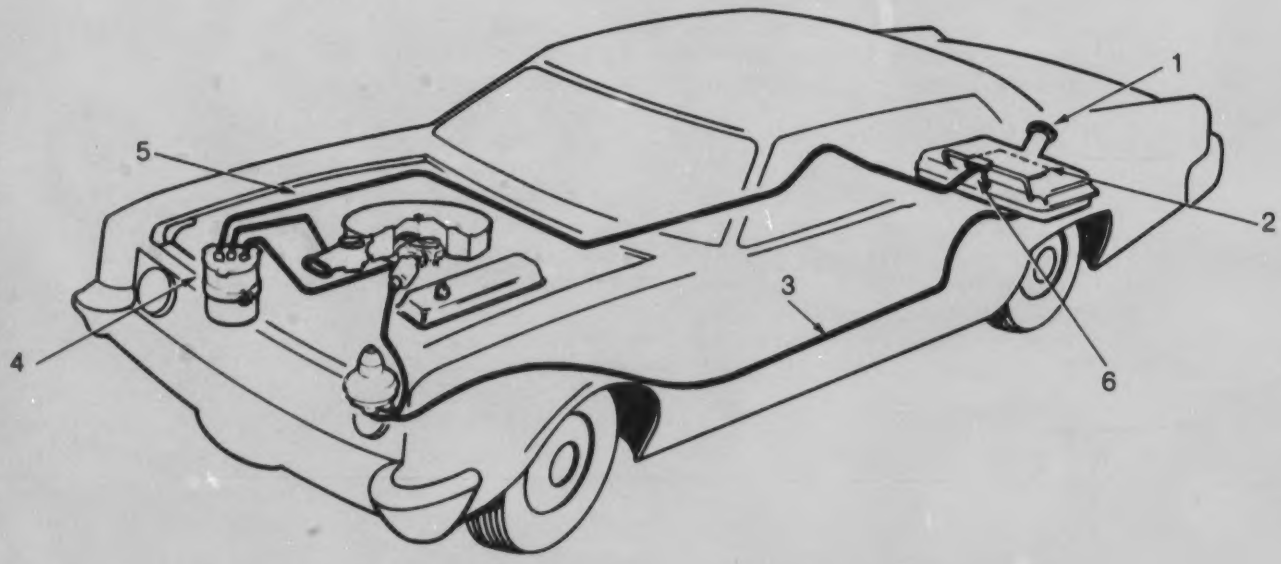
4. Identify each of the parts in the picture by writing the letter of the correct part name in the proper blanks.

Parts

_____ 1.
_____ 2.
_____ 3.
_____ 4.
_____ 5.
_____ 6.

Part Names

a. vapor vent line
b. three-way control valve
c. fuel vapor storage
d. fuel line
e. purge line
f. pressure-vacuum filler cap
g. vapor-liquid separator
h. pressure-vacuum relief valve
i. fuel tank



5. The purpose of the vapor-liquid separator in the evaporative emission control system is to:

_____ a. prevent excessive pressure from building up in the fuel tank
_____ b. allow excess fuel vapors to return to the fuel tank
_____ c. prevent liquid fuel from entering the engine when it is off
_____ d. vaporize the fuel before it reaches the engine

6. In the blanks beside each of the system parts listed below, write the letter(s) of the check(s) you would make when inspecting the evaporative emission control system.

Parts

_____ 1. fuel tank
_____ 2. vapor vent lines
_____ 3. three-way vent control valve
_____ 4. purge line
_____ 5. pressure-vacuum relief cap

Checks

a. Listen for buzzing sounds.
b. Look for kinks or cracks.
c. Look for leaks.
d. Blow into the housing and check for proper operation.
e. Look for loose mountings.

7. What type of fuel tank filler cap is required for vehicles equipped with evaporative emission control systems?

_____ a. vented
_____ b. nonvented

8. How do most vehicle manufacturers recommend the fuel vapor storage filter element be serviced?

_____ a. The filter element should be cleaned every 12,000 miles.
_____ b. The filter element should be replaced every 12,000 miles.
_____ c. The entire fuel vapor storage unit should be replaced every 12,000 miles.

9. What type of hose should be used to replace old vapor vent hose?

_____ a. steel fuel line
_____ b. thick rubber hose
_____ c. plastic hose
_____ d. fuel-resistant hose
_____ e. flexible, fabric fuel line

10. The steps listed below for replacing a charcoal canister filter element are out of order. Write the letter of each step in the blank beside the proper number to show the correct sequence.

Order	Steps
_____ 1.	a. Remove the element by squeezing it out from under the retainer bar.
_____ 2.	b. Snap the bottom cover in place.
_____ 3.	c. Loosen the mounting clamp bolt and slide the canister out.
_____ 4.	d. Reinstall the canister and attach the vapor hoses.
_____ 5.	e. Disconnect and plug the vapor hoses.
_____ 6.	f. Install a new filter element.
_____ 7.	g. Turn the canister upside down and remove the bottom cover of the canister.

11. What component(s) should you replace if you find raw fuel in the fuel vapor storage unit?

_____ a. the pressure-vacuum relief cap
_____ b. the vapor-liquid separator
_____ c. the charcoal canister filter element
_____ d. the pressure-vacuum relief valve

When you finish this pretest, carefully tear it out of the book and give it to your instructor. After s(he) has checked your answers, your instructor will direct you to either practice the work activities or to study the material covered by this test.

EXERCISE 3

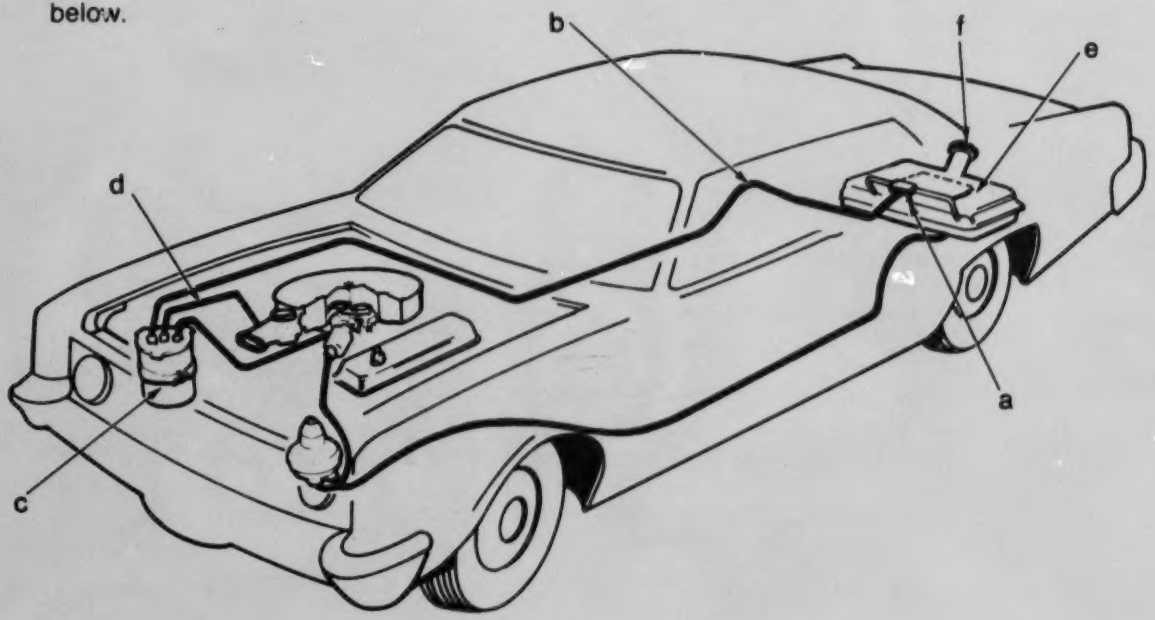
1. Why should you never light a match or smoke while servicing the fuel evaporative emission control system? _____

   _____

2. Why should you never leave vapor lines unplugged when servicing charcoal canisters? _____

   _____

3. Identify the parts of the fuel evaporative emission control system indicated in the diagram below.



a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

4. The purpose of the fuel evaporative emission control system on vehicles is to:

_____ a. prevent fuel spillage from fuel tanks
_____ b. provide the engine with leaner air-fuel mixtures
_____ c. store fuel vapors from fuel tanks and carburetors
_____ d. regulate fuel flow to the carburetor

5. Check each correct answer. Inspection of a fuel evaporation emission control system covers the following parts:

_____ a. fuel pump
_____ b. fuel tank
_____ c. fuel lines
_____ d. fuel vapor vent lines and hoses
_____ e. pressure-vacuum filler cap

6. Check all the correct answers. Once a vehicle engine starts, the fuel evaporative emission control system directs fuel vapors to the:

_____ a. carburetor
_____ b. carburetor air cleaner
_____ c. PCV hose
_____ d. fuel tank

7. The purpose of the vapor-liquid separator is:

_____ a. to pump fuel only to the carburetor
_____ b. to separate the dirt from the fuel
_____ c. to separate fuel vapors from the fuel and allow the fuel to return to the fuel tank
_____ d. to regulate fuel tank pressures

8. To check the operation of a pressure-vacuum filler cap:

_____ a. remove the filler cap and blow against the opening (valve) with your mouth
_____ b. remove the filler cap and blow against the opening (valve) with compressed air and a blowgun
_____ c. check the tightness of the filler cap against the fuel tank filler neck
_____ d. squeeze the vapor vent lines to check for pressure

9. The storage canister is filled with _____ and stores fuel _____.

10. The part in the canister that should be replaced at regular maintenance intervals is the _____.

11. Most canister filters need to be replaced every _____ or _____ miles, or every _____ or _____ months.

Now turn to the back of this book and check your answers for Exercise 3.

EXERCISE 4

1. Vapor hoses are made from special _____ material.

   Only hoses marked _____ should be used for replacement.

2. An open flame near the vapor hoses could cause a/an _____ and a/an _____ .

3. To remove the three-way control valve, you first remove the protective _____ from the valve body. Then disconnect the vapor _____ and the special connector leading to the _____ . Remove the three-way valve _____ bolt and remove the valve.

4. The filler cap for a conventional fuel tank (nonemission system) is a/an _____ type of cap.

5. The filler cap for an evaporative emission control system is a/an _____ type of cap.

6. Complete each statement. In general, to replace a charcoal filter element, you should do the following:

   a. Disconnect the vapor _____ from the top of the canister.

   b. After step a, loosen the _____ clamp bolt and slide the canister from the bracket.

   c. After step b, remove the canister bottom _____ and squeeze the _____ out from under the retainer bar.

   d. After step c, install the new filter, placing it in position evenly around the bottom of the _____ with the edges tucked under the canister _____ .

   e. After step d, put the cover back on the canister and install the canister in the _____ .

Now turn to the back of this book and check your answers for Exercise 4.

PERFORMANCE CHECKLIST—P.O. 34

The instructor will provide either a live vehicle or a shop vehicle for this objective. Perform an operational inspection of an evaporative emission control system and correct any problems you find. All of the performances below must be accomplished.

Student Performances	Instructor Ratings		
	Acceptable	Not Acceptable	Omit
1. Raises vehicle as necessary.			
2. Inspects all hoses and return lines for defects, and replaces as necessary.			
3. Inspects vent control valve, if so equipped, and replaces as necessary.			
4. Lowers vehicle as necessary.			
5. Inspects pressure vacuum filler cap, and replaces as necessary.			
6. Inspects charcoal canister filter element, and replaces as necessary.			
7. Uses proper tools and equipment.			
8. Follows all appropriate safety precautions.			
9. Time.			

Keep a copy of this checklist for your records.

PRETEST—P.O. 35: TAC

NAME _____

1. Place a check (✓) beside all the safety practices listed below that you should follow.

   _____ a. Use fender covers when working under the hood.
   _____ b. Make sure work area has adequate ventilation when operating an engine.
   _____ c. Avoid wearing loose clothing when working around an engine.
   _____ d. Keep long hair under a cap.
   _____ e. Look before reaching into the engine compartment.

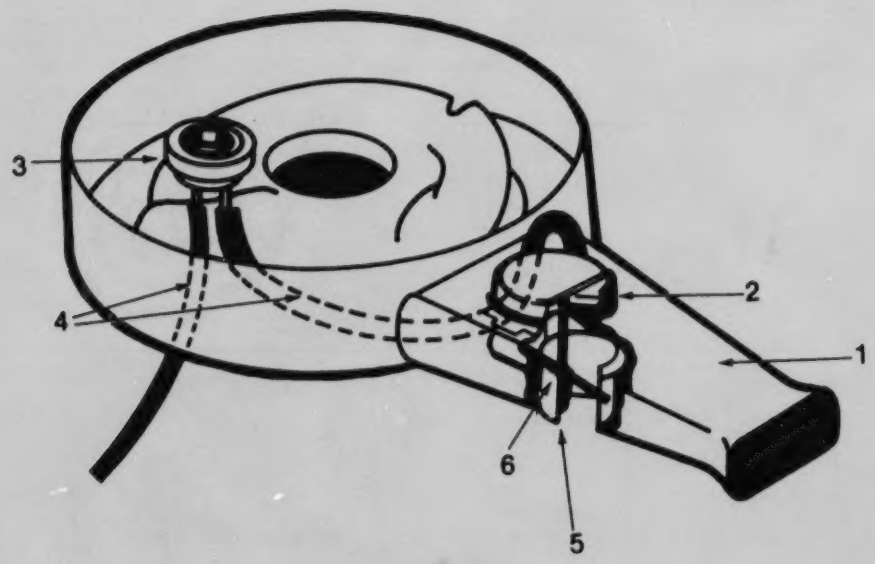
2. The function of the thermostatic air cleaner (TAC) is to:

   _____ a. provide a greater amount of air to an engine so operation will be smoother during warm-up
   _____ b. prevent carburetor icing and vapor lock
   _____ c. provide preheated air to a cold engine for more efficient operation during warm-up
   _____ d. prevent the incoming air to the carburetor from getting hotter than 100° F.

3. What is the source of the heated air that is controlled by the thermostatic air cleaner?

   _____ a. the engine compartment
   _____ b. outside the vehicle
   _____ c. the temperature sensor assembly
   _____ d. the heat stove

20



4. Identify the parts labeled in the picture above by writing the letter of the name of the part in the numbered blanks below.

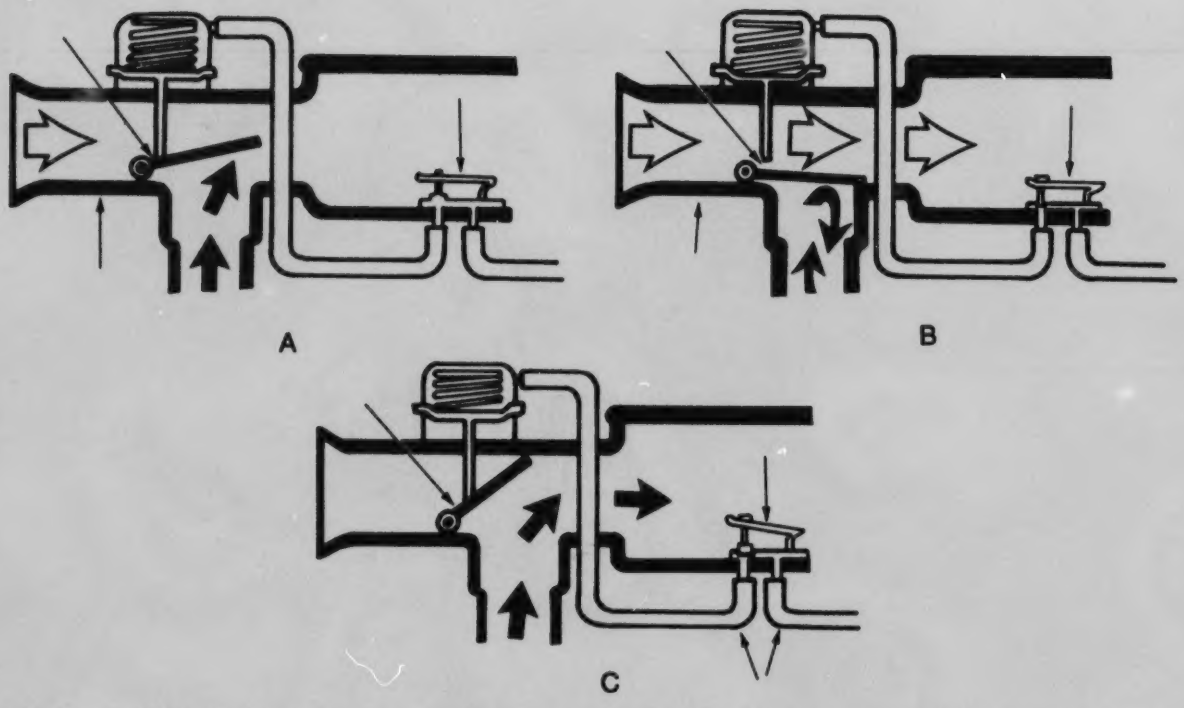
Parts

_____ 1.
_____ 2.
_____ 3.
_____ 4.
_____ 5.
_____ 6.

Part Names

a. air cleaner assembly
b. control damper assembly
c. vacuum hose
d. air bleed valve
e. snorkel tube
f. hot air pipe
g. vacuum motor
h. temperature sensor

5.



A

B

C

Which of the illustrations above shows the correct position of the heat control valve at an air cleaner assembly temperature of 140° F.?

_____ a. A
_____ b. B
_____ c. C

6. Place a check (✓) beside the visual tests that can be performed on the TAC without disassembling the carburetor air cleaner.

_____ a. Check the movement of the temperature sensor.
_____ b. Check the position and movement of the heat control valve.
_____ c. Check the diaphragm spring position and movement.
_____ d. Check all vacuum hoses and connections.

7. Look at the following specifications for some GM vehicles.

TEMPERATURE SENSOR SPECIFICATIONS

Application	Opening Temperature	Closing Temperature
Cadillac (1970–74)		
All V-8	85° F.	105° F.
Chevrolet (1968–74)		
All engines	85° F.	128° F.
Oldsmobile		
All engines (1968–71)	85° F.	128° F.
All engines (1972)	77° F.	123° F.

According to the data in the table above, which of the following statements is true?

_____ a. The damper valve on a 1973 Cadillac V-8 engine should be completely closed to engine compartment air at 110° F.
_____ b. The damper valve on a 1968 Chevrolet 6-cylinder engine should be partly open to engine compartment air at 80° F.
_____ c. The damper valve on a 1971 Oldsmobile V-8 engine should be open only to the heat stove at 100° F.
_____ d. The damper valve on a 1972 Oldsmobile V-8 engine should be completely open to engine compartment air at 125° F.

8. The steps below for testing a TAC on a GM vehicle are out of order. Write the letter of each step in the blank by the proper number to show the correct sequence.

Order

_____ 1.
_____ 2.
_____ 3.
_____ 4.
_____ 5.
_____ 6.
_____ 7.

Steps

a. Allow air cleaner to cool to seven degrees below closing temperature.
b. Install a *tee* fitting in the vacuum line at the snorkel and attach a vacuum gauge.
c. Start the engine for warm-up and, when the damper starts to open, check the temperature and vacuum readings.
d. Remove air cleaner cover and tape a thermometer next to the temperature sensor.
e. Compare readings to specifications.
f. Install air cleaner cover without nut.
g. Verify that damper is open to outside air (engine off).

9. What is the recommended service procedure for a defective GM- or Chrysler-made temperature sensor?

_____ a. Replace the sensor.
_____ b. Adjust the sensor and reinstall.

10. When testing a TAC on a GM vehicle, if the vacuum reading meets specifications, but the temperature reading does not, what action should be taken?

_____ a. Replace the vacuum motor.
_____ b. Replace the temperature sensor.
_____ c. Replace the damper door.
_____ d. Replace the vacuum motor and the temperature sensor.

11. Which of the following results would most likely be observed when testing a ***defective*** Chrysler-made TAC?

_____ a. Vacuum applied to the vacuum diaphragm is held for at least five minutes.
_____ b. The damper door should not be in the ***full up*** position until 20 inches of vacuum are applied.
_____ c. The damper door should not start to rise until 5 inches of vacuum are applied.
_____ d. The damper door should be in the ***down*** position when air temperature at snorkel is more than 105° F.

12. The steps below for replacing the vacuum diaphragm on a Chrysler-made TAC are out of order. Write the letter of each step in the blank by the proper number to show the correct sequence.

Order	Steps
_____ 1.	a. Check damper door operation by applying vacuum to the diaphragm hose.
_____ 2.	b. Slide diaphragm assembly aside, disengage operating rod, and remove diaphragm assembly.
_____ 3.	c. Reinstall air cleaner assembly, and test operation.
_____ 4.	d. Insert diaphragm rod into heat control door. Position and engage diaphragm in snorkel.
_____ 5.	e. Remove air cleaner assembly and disconnect vacuum hose. Disengage diaphragm.
_____ 6.	f. Check damper door for free operation. Check walls of snorkel for obstacles to damper door.

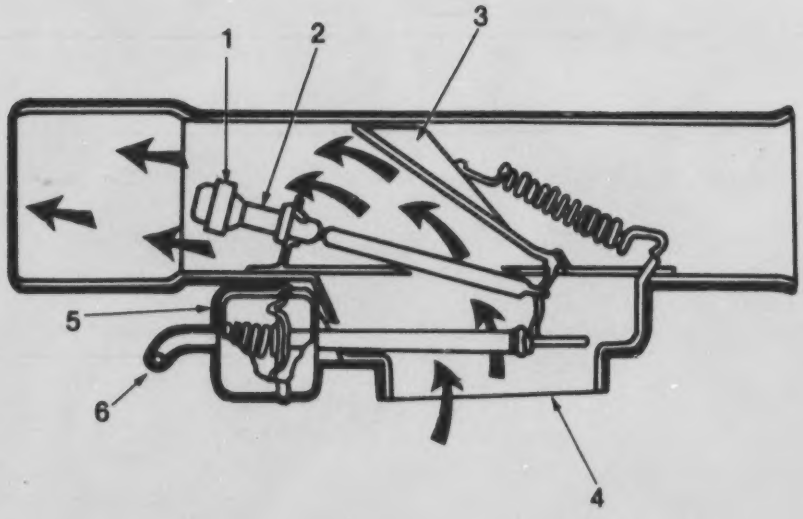
13. Which of the following statements about the Ford-made TAC is correct?

_____ a. A Ford TAC with a thermostatic bulb must reach a higher temperature before shutting the valve plate than a TAC with a bi-metal switch.
_____ b. A Ford TAC with a bi-metal switch must reach a higher temperature before shutting the valve plate than a TAC with a thermostatic bulb.

14. The function of the auxiliary air inlet valve on a Ford-made TAC is to:

_____ a. allow additional air to enter the carburetor when engine vacuum is high (idle speeds)
_____ b. prevent the loss of vacuum needed to operate the vacuum override motor
_____ c. equalize air temperature in the engine compartment and the air cleaner assembly
_____ d. allow additional air to enter the air cleaner assembly when the engine is accelerated

15.



Identify the parts labeled in the picture above by writing the letters of the part names in the number blanks below.

Parts	Part Names
_____ 1.	a. bi-metal switch
_____ 2.	b. vacuum hose
_____ 3.	c. air bleed valve
_____ 4.	d. exhaust manifold shroud tube
_____ 5.	e. thermostat rod
_____ 6.	f. auxiliary air inlet valve
	g. valve plate
	h. thermostatic bulb
	i. vacuum override motor

16. Place a check (✓) beside all the recommended actions for a Ford-made TAC that does not function properly during the visual check of valve plate operation.

_____ a. Check valve plate assembly operation by placing it in a can of water and heating to specified temperatures.
_____ b. Replace the thermostatic bulb.
_____ c. Replace the vacuum override motor.
_____ d. Check valve plate assembly for binding.
_____ e. Hook up a vacuum pump to the vacuum override motor and apply the specified vacuum.

17. If the valve plate on a Ford-made TAC that has a bi-metal switch does not operate properly, and the bi-metal switch is good, what part could *not* be defective?

_____ a. vacuum hoses
_____ b. thermostatic bulb
_____ c. auxiliary air injection valve
_____ d. vacuum motor

18. What would be the recommended service procedure for a 1973 Ford vehicle with a malfunctioning thermostatic valve?

_____ a. Adjust the position of the thermostatic valve.
_____ b. Install a new thermostatic valve.

When you finish this pretest, carefully tear it out of the book and give it to your instructor. After s(he) has checked your answers, your instructor will direct you to either practice the work activities or to study the material covered by this test.

EXERCISE 5

1. Why is it unsafe to operate a vehicle engine in a closed building without good ventilation? ____

   _____

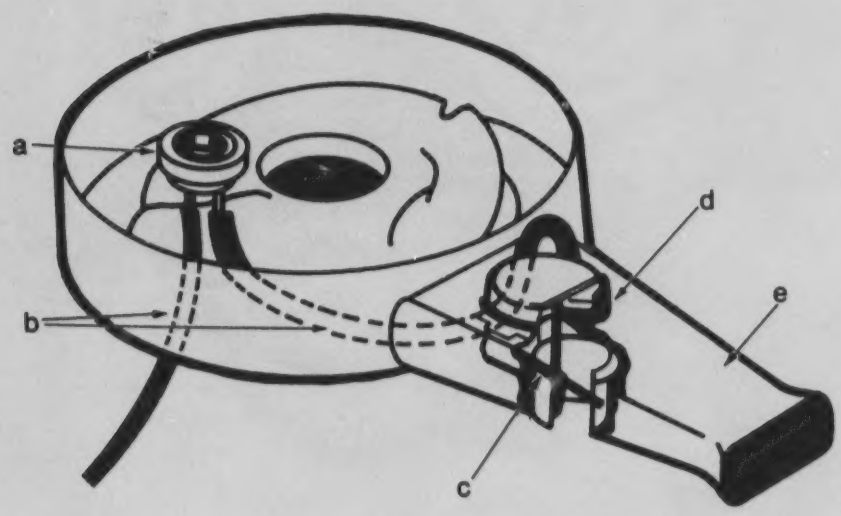
2. Why is it unsafe to leave the HC-CO tester sampling hose and probe tip on the shop floor after completing the vehicle testing activity? _____

   _____

3. All American-made vehicles have been equipped with thermostatically controlled carburetor air cleaners since _____ .

4. The purpose of the thermostatically controlled air cleaner is to help _____ the air-fuel mixture when the engine is _____ .

5. Name the parts of the GM thermostatic air cleaner indicated in the diagram below.



a. _____

b. _____

c. _____

d. _____

e. _____

6. The operation of the GM thermostatic air cleaner is such that:

   a. when the engine is cold, the damper valve is _____ to the manifold heat stove.

   b. when the air temperature reaches approximately _____ ° F., the damper valve _____ the hot air from the heat stove.

7. The thermal sensor regulates the amount of vacuum directed to the _____ .

8. Thermostatic air cleaners should be checked every _____ miles or every _____ months.

9. Every time you inspect any thermostatic air cleaner, you should first make a visual check of:

   a. the condition and connections of the _____

   b. the position and the operation of the _____

10. The thermostatic air cleaner could be at fault if:

   a. the engine _____ or _____ poorly when it is cold

   b. the engine _____ when it is hot

11. Complete each statement. To check the operation of the sensor and the vacuum motor of a GM thermostatic air cleaner, you should do the following:

   a. Place a _____ next to the sensor in the air cleaner.

   b. After step a, install a vacuum _____ in the vacuum hose to the vacuum motor.

   c. After step b, start the engine. With the engine cold, the damper valve should _____ _____ against outside air.

   d. After step c, when the damper valve is fully open, immediately check the _____ reading and the _____ reading; readings should match the manufacturer's specifications.

12. If the vacuum gauge reading is correct, but the temperature is not within manufacturer's specifications, replace the:

_____ a. vacuum control motor
_____ b. thermal sensor
_____ c. air filter element
_____ d. vacuum hose

13. If both the temperature and the vacuum readings are not within specifications, replace the:

_____ a. vacuum control motor
_____ b. thermal sensor
_____ c. air filter element
_____ d. vacuum hose

Now turn to the back of this book and check your answers for Exercise 5.

EXERCISE 6

1. Check all the correct answers. To inspect a thermostatic air cleaner for any malfunctions, first you would visually check:

   _____ a. the condition of all the vacuum hoses and their connections
   _____ b. the condition of the connector from the manifold heat stove connections
   _____ c. the manifold heat stove to see that it is mounted in place securely
   _____ d. the position of the damper valve in the snorkel of the air cleaner when the engine is cold
   _____ e. the position of the damper valve in the snorkel of the air cleaner when the engine is at operating temperatures

2. The damper valve on the Chrysler-made thermostatic air cleaner should close at:

   _____ a. 85° F.
   _____ b. 105° F. or higher
   _____ c. 90° F.
   _____ d. 120° F.

3. The first test to be done on a Chrysler-made air cleaner is to:

   _____ a. test the vacuum diaphragm by applying 20 inches of Hg with a vacuum pump
   _____ b. test the sensor by applying 20 inches of Hg with a vacuum pump
   _____ c. test the air temperature at which the damper valve is in the down position or closes off the hot air from the heat stove
   _____ d. test the air cleaner element for dirt, using a light bulb

4. Using the same choices given for question #3, indicate the second test to be done if the first test results are unsatisfactory.

   _____ a.
   _____ b.
   _____ c.
   _____ d.

5. Using the same choices given for question #3, indicate the next test to be done if the second test results are unsatisfactory.

   _____ a.
   _____ b.
   _____ c.
   _____ d.

6. If the vacuum diaphragm is okay, but the damper valve does not close at the proper temperature, the _____ should be replaced.

7. If the vacuum diaphragm leaks, the _____ should be replaced.

8. Complete each statement. To remove the thermal sensor in a Chrysler-made thermostatic air cleaner, you should do the following:

a. Remove the _____ from the vehicle.

b. After step a, turn the air cleaner housing over and remove the

_____ that hold(s) the sensor securely to the housing.

c. Remove the _____ and the _____ from inside the air cleaner housing.

9. Complete each statement. To remove the vacuum diaphragm from a Chrysler-made thermostatic air cleaner, you should do the following:

a. Disconnect the _____ from the diaphragm.

b. Tip the _____ slightly forward to disengage the

_____, and rotate the diaphragm

_____.

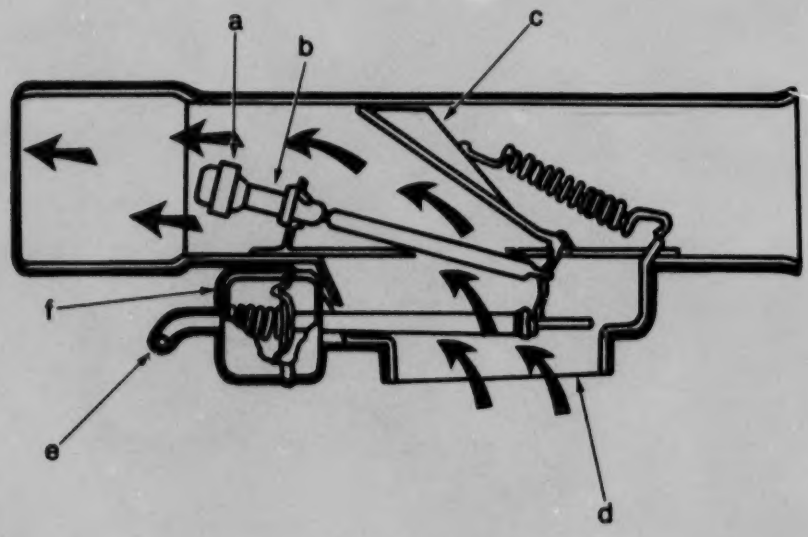
c. Slide the complete assembly to one side and disengage the operating

_____ from the _____.

Now turn to the back of this book and check your answers for Exercise 6.

EXERCISE 7

1. Name the parts of the Ford/AMC-made thermostatic air cleaner indicated in the diagram below:



a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

2. The part that controls the opening and closing of the valve plate is the:

_____ a. vacuum override motor
_____ b. valve plate spring
_____ c. thermostat bulb
_____ d. vacuum override motor piston rod

3. The valve plate is open to the heat stove until the temperature of the air in the cleaner housing reaches about:

_____ a. 100° F.
_____ b. 75° F.
_____ c. 125° F.
_____ d. 50° F.

4. The override motor is used to close the valve plate when the engine is cold and when the engine:

_____ a. stalls
_____ b. pings
_____ c. accelerates
_____ d. is idling

5. On thermostatic air filters that have a bi-metal switch and a vacuum diaphragm, the valve plate closes against the hot air coming from the heat stove when the air temperature reaches:

_____ a. 80° F.
_____ b. 100° F.
_____ c. 50° F.
_____ d. 120° F.

6. The auxiliary air inlet valve is used to provide additional carburetor air when the engine:

_____ a. stalls
_____ b. pings
_____ c. accelerates
_____ d. is idling

7. Complete each statement. To test the thermostatic bulb and valve plate operation, you should do the following:

a. Remove the _____ from the air cleaner and put it in a can of _____ and place the can on a/an _____ .

b. After step a, place a/an _____ in the _____ and heat the water until the temperature reaches _____ .

c. After step b, the valve plate should be fully _____ to outside air.

8. To test the operation of the vacuum override motor, a/an _____ _____ is used.

9. To test a bi-metal switch to see if it operates, place it in _____ and heat it to a temperature of _____ .

10. Complete each statement. To test an auxiliary air inlet valve, you should do the following:

a. Remove the cover from the air cleaner.

b. After step a, start the engine and look at the _____ ; it should be fully _____ .

c. After step b, disconnect the _____ at the valve; the plate should move to full _____ .

Now turn to the back of this book and check your answers for Exercise 7.

PERFORMANCE CHECKLIST—P.O. 35
GENERAL MOTORS TAC SYSTEM

Your instructor will provide a GM-made vehicle that has a TAC system. Test the system and correct any problems you find. All of the performances below must be accomplished.

Student Performances	Instructor Ratings		
	Acceptable	Not Acceptable	Omit
1. Inspects the thermostatic air cleaner system on a GM vehicle.			
2. Tests the operation of the thermostatic air cleaner system on a GM vehicle.			
3. Removes and installs a TAC sensor on a GM vehicle.			
4. Removes and installs a TAC damper assembly on a GM vehicle.			
5. Uses vacuum-pressure gauge and thermometer.			
6. Follows all appropriate safety precautions.			
7. Time.			

Keep a copy of this checklist for your records.

PERFORMANCE CHECKLIST—P.O. 35: CHRYSLER TAC SYSTEM

Your instructor will provide a Chrysler-made vehicle that has a TAC system. Test the system and correct any problems you find. All of the performances below must be accomplished.

Student Performances	Instructor Ratings		
	Acceptable	Not Acceptable	Omit
1. Inspects the thermostatic air cleaner system on a Chrysler-made vehicle.			
2. Tests the operation of the thermostatic air cleaner system on a Chrysler-made vehicle.			
3. Removes and installs a TAC sensor on a Chrysler-made vehicle.			
4. Removes and installs a TAC vacuum diaphragm on a Chrysler-made vehicle.			
5. Uses vacuum pressure pump-gauge and thermometer.			
6. Follows all appropriate safety precautions.			
7. Time.			

Keep a copy of this checklist for your records.

PERFORMANCE CHECKLIST—P.O. 35
FORD/AMC TAC SYSTEM

Your instructor will provide a Ford or AMC vehicle that has a TAC system. Test the system and correct any problems you find. All of the performances below must be accomplished.

Student Performances	Instructor Ratings		
	Acceptable	Not Acceptable	Omit
1. Inspects the thermostatic air cleaner system of a Ford vehicle.			
2. Tests the operation of the thermostatic air cleaner system of a Ford vehicle.			
3. Tests the operation of the thermostatic bulb on the TAC system of a Ford vehicle.			
4. Tests the operation of a vacuum override motor on the TAC system of a Ford vehicle.			
5. Tests the operation of a bi-metal switch on the TAC system of a Ford vehicle.			
6. Tests the operation of an auxiliary air inlet valve on the TAC system of a Ford vehicle.			
7. If available, adjusts the thermostatic bulb setting on a TAC system of a Ford vehicle.			
8. Uses thermometer, hot plate, and vacuum-pressure gauge.			
9. Follows all appropriate safety precautions.			
10. Time.			

Keep a copy of this checklist for your records.

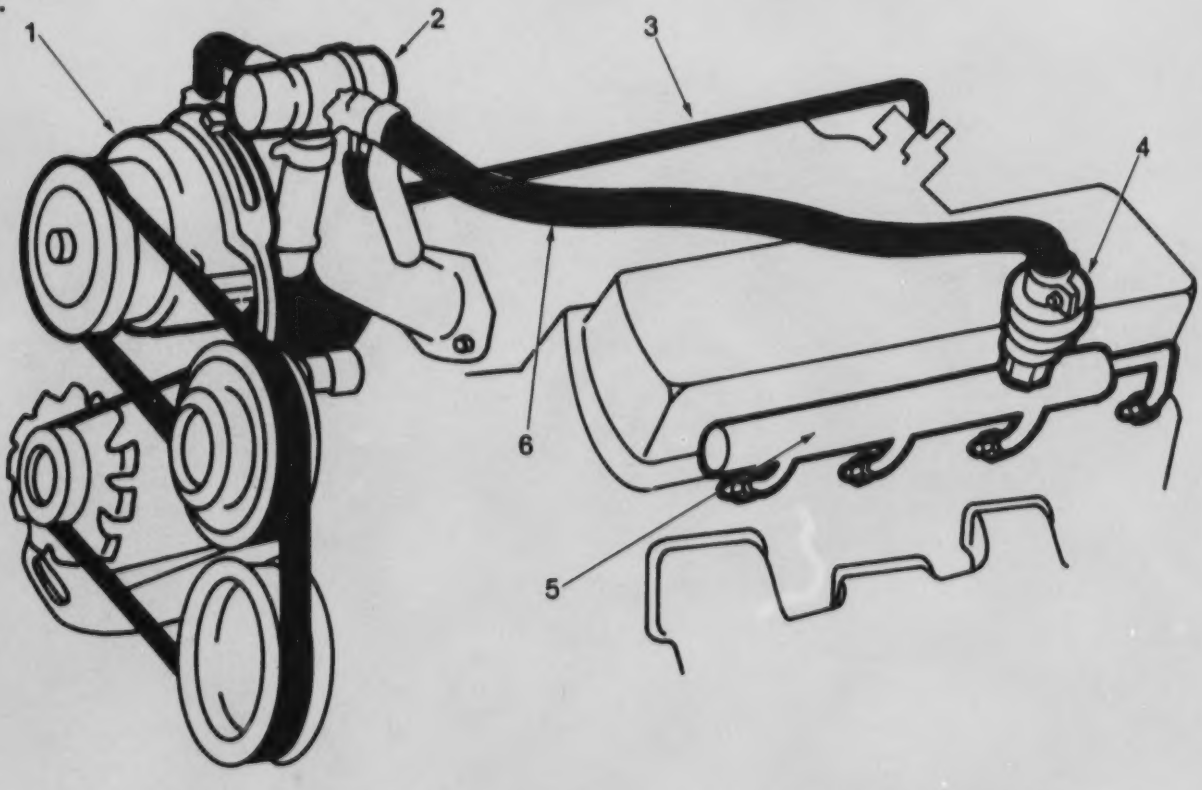
PRETEST—P.O. 36: AIR

NAME _____

1. Place a check (✓) beside all the safety practices listed below that you should follow.

   _____ a. Look before reaching when working around an operating engine.
   _____ b. Avoid wearing jewelry when working around an engine.
   _____ c. Wear properly fitting clothes and avoid letting shirttails hang out.
   _____ d. Use a fender cover only if you are wearing a belt.
   _____ e. Keep long hair under a cap.

2.



Identify the parts labeled in the picture above by writing the letter of the name of the part in the numbered blanks below.

Parts	Part Names
_____ 1.	a. air manifold assembly
_____ 2.	b. gulp valve
_____ 3.	c. air pump
_____ 4.	d. intake manifold vacuum line
_____ 5.	e. centrifugal filter fan
_____ 6.	f. check valve
	g. air hose
	h. air bypass valve assembly

3. The air injection system functions on an automobile by:
   _____ a. providing a low-pressure boost of air to the intake manifold for cleaner burning of gasoline
   _____ b. recirculating unburned exhaust gases under pressure to the carburetor for more complete combustion
   _____ c. mixing fresh air under pressure with unburned exhaust gases at the exhaust manifold for more complete combustion
   _____ d. preventing pressurized exhaust gases from leaving the exhaust manifold until the excess pressure has been reduced

4. Which of the following terms does *not* mean the same thing as ***anti-backfire valve?***
   _____ a. air bypass valve
   _____ b. gulp valve
   _____ c. diverter valve
   _____ d. check valve

5. How many check valves would be found on a V-8 automotive engine equipped with an air injection system?
   _____ a. none
   _____ b. one
   _____ c. two
   _____ d. three or more

6. What is the difference between a gulp valve and a diverter valve in air injection systems?
   _____ a. The gulp valve sends excess air to the intake manifold, while the diverter valve sends excess air to the atmosphere.
   _____ b. The gulp valve operates only during engine acceleration, while the diverter valve operates at engine idle and deceleration.
   _____ c. The gulp valve does not require separate check valve(s), while the diverter valve does require separate check valve(s).

7. When any part of the air injection system is found to be defective, what is the recommended service procedure?
   _____ a. Replace the part.
   _____ b. Repair the part.

8. Place a check (✓) beside all the parts that should be replaced if you find burned air hoses in an air injection system.
   _____ a. diverter valve
   _____ b. air pump
   _____ c. air hose
   _____ d. centrifugal filter fan
   _____ e. check valve

9. How should air manifolds and hoses be checked on an air injection system?
   _____ a. Operate engine at 1500–2000 RPM and listen for squealing or knocking noises.
   _____ b. Visually inspect for defects and operate engine to detect any leaking air.
   _____ c. Check that ample vacuum is present in all air hoses when the engine is at 1500 RPM.
   _____ d. Pressure-test the system with a cooling system tester.

10. Which of the following statements would be true of a properly operating air pump?

_____ a. The air pump should be making noise, which will increase as engine speed increases.
_____ b. The air pump should be very quiet except when the engine is quickly accelerated.
_____ c. If the air pump is making any noise, it should be a hissing sound or knocking sound.

11. Which of the following output test results would indicate a faulty air pump?

_____ a. No air flow from diverter valve muffler when the engine is accelerated.
_____ b. No air flow as engine speed is decreased.
_____ c. An increase in air flow as engine speed is increased.
_____ d. No knocking noises from the air pump.

12. Which of the following test results would indicate a good diverter valve?

_____ a. a short blast of air from the diverter valve muffler as the engine throttle is quickly opened and shut
_____ b. a short suction at the diverter valve muffler as the engine throttle is quickly opened
_____ c. a continuous flow of air from the diverter valve muffler at engine idle speeds
_____ d. no flow of air from the diverter valve muffler at any engine speed

13. Which of the following conditions would *not* be responsible for excessive air pump rumbling or knocking?

_____ a. a faulty check valve
_____ b. a faulty diverter valve
_____ c. leaky or loose air hoses
_____ d. a loose air pump belt
_____ e. insufficient air pump break-in

14. Place a check (✓) beside all the special precautions listed below that you should follow when servicing an air injection system.

_____ a. All external filters should be cleaned.
_____ b. The air pump should be lubricated at specified intervals.
_____ c. The air injection system should be serviced at least every 12 months or 12,000 miles.
_____ d. Air nozzles can be cleaned if plugged with carbon deposits.
_____ e. The proper sized tools should be used when working on the air injection system.

15. Where on the air pump should you apply a pry bar when removing or replacing the air pump or air pump belt?

_____ a. just behind the centrifugal filter fan
_____ b. at the air pump drive pulley
_____ c. at the rear of the air pump cover
_____ d. at the centrifugal filter fan

16. The steps below for removing and installing a centrifugal filter fan on an air pump are out of order. Write the letter of each step in the blank beside the proper number to show the correct sequence.

Order	Steps
_____ 1.	a. Install new filter fan and old pulley.
_____ 2.	b. Pry air pump toward engine and remove drive belt.
_____ 3.	c. Pry outer disc loose and pull off centrifugal filter fan.
_____ 4.	d. Install drive belt and tighten air pump adjusting and mounting bolts.
_____ 5.	e. Install drive pulley attaching bolts and torque bolts to specifications.
_____ 6.	f. Loosen air pump adjusting bolt and mounting bolt.
_____ 7.	g. Remove drive pulley retaining bolts and pull drive pulley from pump shaft.

17. When replacing a pressure relief valve in an air pump, what should be done with the pressure-setting plug?

_____ a. The plug should also be replaced.
_____ b. The plug should be lubricated and reinstalled.
_____ c. The plug should be removed until the new pressure relief valve is installed, then pressed back into place.
_____ d. The plug should be cleaned, tested, and reinstalled before the new pressure relief valve is installed.

18. What special tools are required when replacing a pressure relief valve?

_____ a. a bench vise and torque wrench
_____ b. a pry bar and a small diameter drill bit
_____ c. a steel bridge and gear puller
_____ d. a ball peen hammer and a bench vise

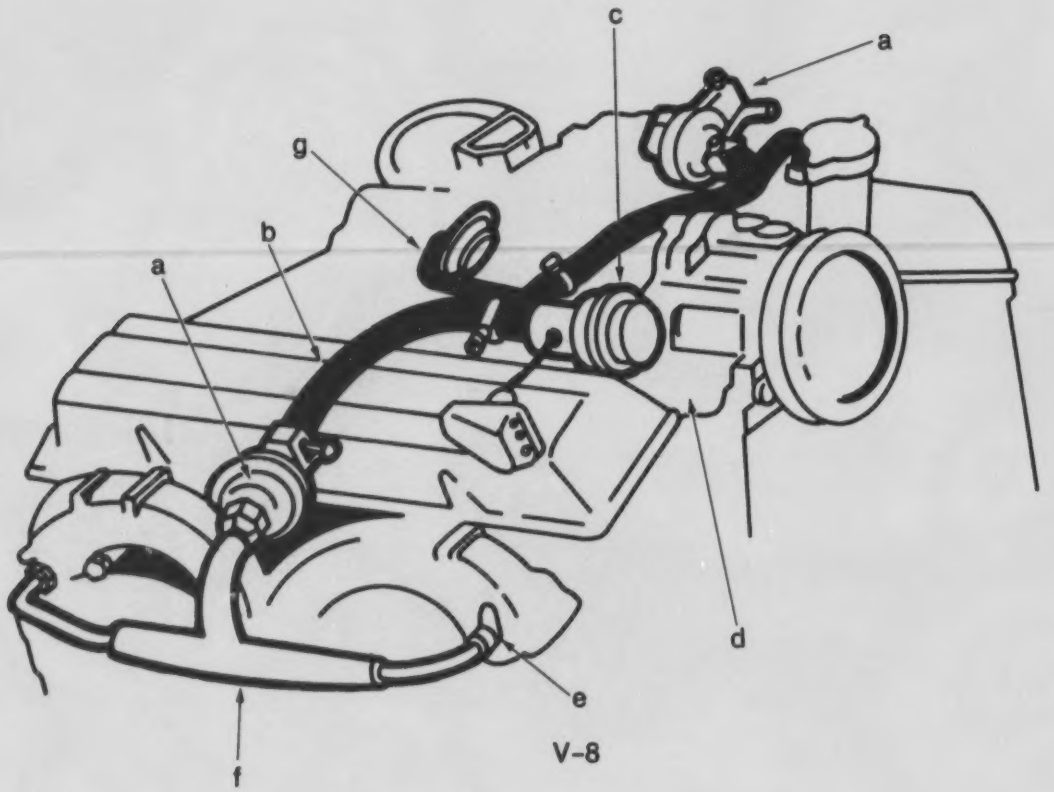
19. What is the last step you would take after replacing any parts on an air injection system?

_____ a. Torque all bolts to proper specifications.
_____ b. Check air pump drive belt tension.
_____ c. Make an operational check of the air injection system.

When you finish this pretest, carefully tear it out of the book and give it to your instructor. After s(he) has checked your answers, your instructor will direct you to either practice the work activities or to study the material covered by this test.

EXERCISE 8

1. Name the parts of an air injection system indicated in the diagram below:



V-8

a. _____ e. _____

b. _____ f. _____

c. _____ g. _____

d. _____

2. The purposes of the air injection system is to create a/an _____ condition in the exhaust manifold.

3. The air pump supplies the air injection system with low-pressure _____ .

4. The diverter valve may also be called a/an:

_____ a. check valve
_____ b. exhaust valve
_____ c. vent valve
_____ d. anti-backfire valve

5. The diverter valve is operated by:

_____ a. exhaust gas pressure
_____ b. the air pump
_____ c. the driver
_____ d. high manifold vacuum

6. The function of the diverter valve is to dump the air from the air injection system into the atmosphere during engine _____ .

7. The check valve is a/an:

_____ a. one-way flow control valve
_____ b. filtering device
_____ c. muffler
_____ d. anti-backfire valve

8. When checking air manifolds and hoses, soapy water can be used to locate _____ .

9. A squealing air pump belt may be caused by a/an _____ belt or a/an _____ pump.

10. Complete each statement. To check the air pump output, you should do the following:

a. Disconnect the air hose from the _____ .

b. After step a, start the engine and check the _____ from the pump.

c. After step b, accelerate the engine to approximately _____ RPM; the air flow should _____ as engine speed increases.

11. Complete each statement. To test the operation of the diverter valve, you should do the following:

a. Start the engine, disconnect the _____ line, and check to see that there is _____ supply to the diverter; then reconnect the line.

b. After step a, place your hand by the diverter valve _____ and quickly open and close the throttle; a blast of _____ should come out of the _____ .

12. A burned hose that is discovered near a check valve indicates a defective _____ _____ .

13. Complete each statement. To check the operation of a check valve, you should do the following:

a. Start the engine and, with the engine operating, disconnect the _____ _____ from the check valve.

b. After step a, operate the engine at approximately _____ RPM while looking for _____ leakage at the valve.

Now turn to the back of this book and check your answers for Exercise 8.

EXERCISE 9

1. Indicate three services that can be performed on an air pump.
   _____ a. replacing the drive shaft
   _____ b. replacing the filter fan
   _____ c. replacing the entire pump assembly
   _____ d. replacing the pressure relief valve
   _____ e. replacing the bearings

2. Before you install a new pressure relief valve on a pump, you should first remove the:
   _____ a. pressure-setting plug
   _____ b. filter fan
   _____ c. pulley
   _____ d. pump belt

3. Backfiring during deceleration may be caused by a defective:
   _____ a. check valve
   _____ b. pressure relief valve
   _____ c. diverter valve
   _____ d. carburetor air cleaner

4. Number in proper sequence the steps that you should follow to remove a centrifugal filter fan.
   _____ a. Remove the drive pulley.
   _____ b. Remove the drive belt.
   _____ c. Remove the filter fan.
   _____ d. Loosen adjusting bolt and mounting bolt.

5. Number in proper sequence the steps that you should follow to remove an air pump.
   _____ a. Loosen the pump mounting bolt.
   _____ b. Remove the belt adjusting bolt.
   _____ c. Remove the pump mounting bolt.
   _____ d. Disconnect the air outlet hose and the intake manifold vacuum sensing line from the diverter.
   _____ e. Remove the air pump from the vehicle.
   _____ f. Remove the pump belt.

6. Number in proper sequence the steps that you should follow to remove a diverter valve.
   _____ a. Remove the two mounting bolts of the diverter.
   _____ b. Remove the diverter and its gasket from the air pump.
   _____ c. Disconnect the outlet air hose and the vacuum sensing line.

7. An air injection system should be serviced every:
   _____ a. 12,000 miles or 12 months
   _____ b. 6,000 miles or 6 months
   _____ c. 24,000 miles or 24 months
   _____ d. 30,000 miles or 30 months

Now turn to the back of this book and check your answers for Exercise 9.

PERFORMANCE CHECKLIST—P.O. 36

Your instructor will provide a vehicle that has an air injection system. Test the system and correct any problems you find. All of the performances below must be accomplished.

Student Performances	Instructor Ratings		
	Acceptable	Not Acceptable	Omit
1. Inspects the air injection system of a vehicle.			
2. Tests the air pump output of the air injection system.			
3. Tests the operation of the diverter valve of the air injection system.			
4. If available, tests the operation of the gulp valve of the air injection system.			
5. Tests the operation of the check valve of the air injection system.			
6. Removes, installs, and adjusts the air pump drive belt of an air injection system.			
7. Removes, services, and installs the air pump of an air injection system.			
8. Removes and installs the diverter valve of an air injection system.			
9. Removes and installs the check valve of an air injection system.			
10. Uses proper tools and equipment.			
11. Follows all appropriate safety precautions.			
12. Time.			

Keep a copy of this checklist for your records.

PRETEST—P.O. 37: EGR

NAME _____

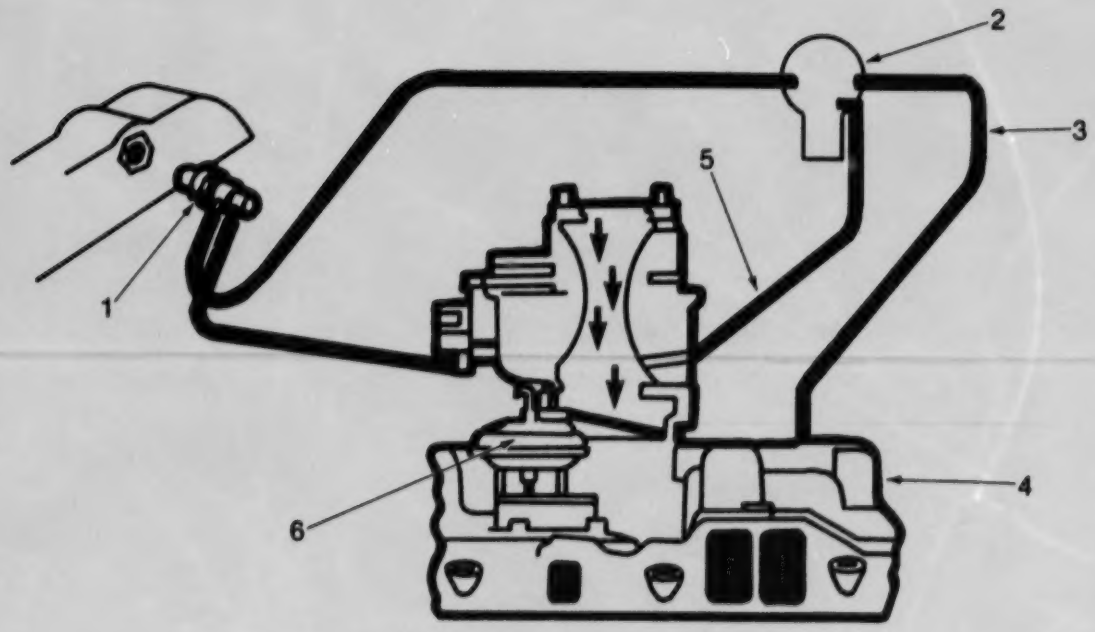
1. What type of exhaust gas recirculation (EGR) system is most widely used on late-model automobiles?
   _____ a. the floor jet system
   _____ b. the valve-controlled system
   _____ c. the venturi vacuum EGR system
   _____ d. the poppet-metered EGR system

2. The EGR system helps reduce the amount of:
   _____ a. CO emissions
   _____ b. HC emissions
   _____ c. NO_x emissions
   _____ d. CO_2 emissions
   _____ e. H_2SO_4 emissions

3. The reason that the EGR system reduces certain emissions is that:
   _____ a. the amount of exhaust gas the engine produces is reduced
   _____ b. the amount of fresh air the engine uses is increased
   _____ c. the temperature of the exhaust gas is increased
   _____ d. the temperature of engine combustion is reduced

4. EGR systems equipped with a vacuum amplifier use a vacuum signal received from:
   _____ a. the carburetor venturi
   _____ b. the carburetor port
   _____ c. the intake manifold port
   _____ d. the coolant control valve port

5.



Label the parts identified in the picture above.

Parts

_____ 1.
_____ 2.
_____ 3.
_____ 4.
_____ 5.
_____ 6.

a. EGR valve
b. vacuum amplifier
c. intake manifold
d. venturi vacuum
e. carburetor port vacuum
f. coolant control valve
g. intake manifold vacuum
h. floor jet valve

6. The EGR system operates when the engine is at:

_____ a. idle
_____ b. wide-open throttle
_____ c. constant cruise speed
_____ d. cold temperature

7. Most EGR systems do not operate until:

_____ a. engine vacuum at the vacuum amplifier reaches 5–8 inches
_____ b. oil temperature exceeds 100° F.
_____ c. coolant temperature exceeds 180° F.
_____ d. engine vacuum at carburetor signal port reaches 3–5 inches

8. A malfunctioning EGR system may result in:

_____ a. burned engine intake valves
_____ b. poor fuel economy
_____ c. shorter muffler life
_____ d. increased intake manifold wear

9. The proper way to check a floor jet EGR system is to:

_____ a. visually inspect the floor jets
_____ b. check floor jet operation under low and high engine vacuum
_____ c. test floor jet operation with engine at idle and at 1500–2000 RPM
_____ d. remove and pressure-test the floor jets, using an external vacuum source

10. For a cold engine (less than 60° F.) equipped with an EGR valve and operating at 2000 RPM, how much vacuum should be present at the EGR valve?

_____ a. none
_____ b. .5 inch
_____ c. 1–3 inches
_____ d. 5–8 inches

11. What part should be replaced if there is no vacuum at the EGR valve when a warm engine is running at 2000 RPM?

_____ a. the EGR valve
_____ b. the vacuum amplifier
_____ c. the coolant control valve
_____ d. the exhaust back pressure sensor

12. If an engine that is idling at normal operating temperature is quickly accelerated to 2000 RPM and then released, a good EGR valve would:

_____ a. register zero vacuum
_____ b. register 3–5 inches of vacuum
_____ c. show no movement
_____ d. show valve stem movement

13. During a test of a defective EGR valve located in the engine intake manifold, applying vacuum to the valve at idle speed should cause:

_____ a. a drop in engine RPM
_____ b. no change in engine RPM
_____ c. rough idling
_____ d. an increase in engine RPM

14. What is the allowable tolerance in vacuum readings during a venturi vacuum amplifier test?

_____ a. .5 inch or less
_____ b. 1 inch or less
_____ c. 2.5 inches or less
_____ d. 5 inches or less

15. As the engine throttle is quickly accelerated and released during a test of the carburetor EGR ports, the vacuum reading should:

_____ a. fall, then rise
_____ b. show no change
_____ c. rise, then fall

16. The recommended service procedure for a malfunctioning carburetor EGR port is to:

_____ a. overhaul the carburetor
_____ b. clean the port
_____ c. replace the throttle body
_____ d. replace the carburetor

17. What should be used to clean floor jets?

_____ a. a small-diameter drill bit
_____ b. manifold heat control lubricant
_____ c. carburetor cleaner solvent
_____ d. silicone spray lubricant
_____ e. light-weight engine oil

18. What special tool is required when you service floor jets?

_____ a. an extension magnet
_____ b. a gasket scraper
_____ c. an offset wrench
_____ d. a torque wrench

19. The EGR coolant control valve must be removed with:

_____ a. a pinch-pry bar
_____ b. a wrench
_____ c. a Phillips screwdriver
_____ d. a torque wrench

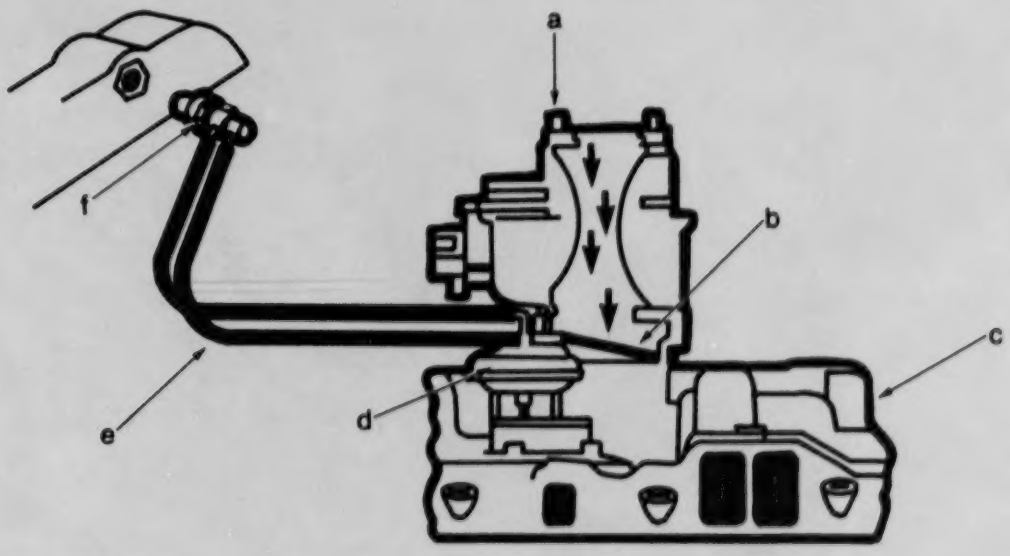
20. The steps below for removing and installing an EGR valve are out of order. Write the letter of each step in the blank by the proper number to show the correct sequence.

Order	Steps
_____ 1.	a. Clean the EGR valve seat area.
_____ 2.	b. Install the EGR valve with new gasket.
_____ 3.	c. Inspect valve for deposit buildup; clean if necessary.
_____ 4.	d. Remove old gasket material from EGR valve mounting base.
_____ 5.	e. Check diaphragm as directed by manufacturer.
_____ 6.	f. Remove EGR valve, gasket, and clamp.

When you finish this pretest, carefully tear it out of the book and give it to your instructor. After s(he) has checked your answers, your instructor will direct you to either practice the work activities or to study the material covered by this test.

EXERCISE 10

1. Identify the components of the ported vacuum control exhaust gas recirculation system indicated in the diagram below.

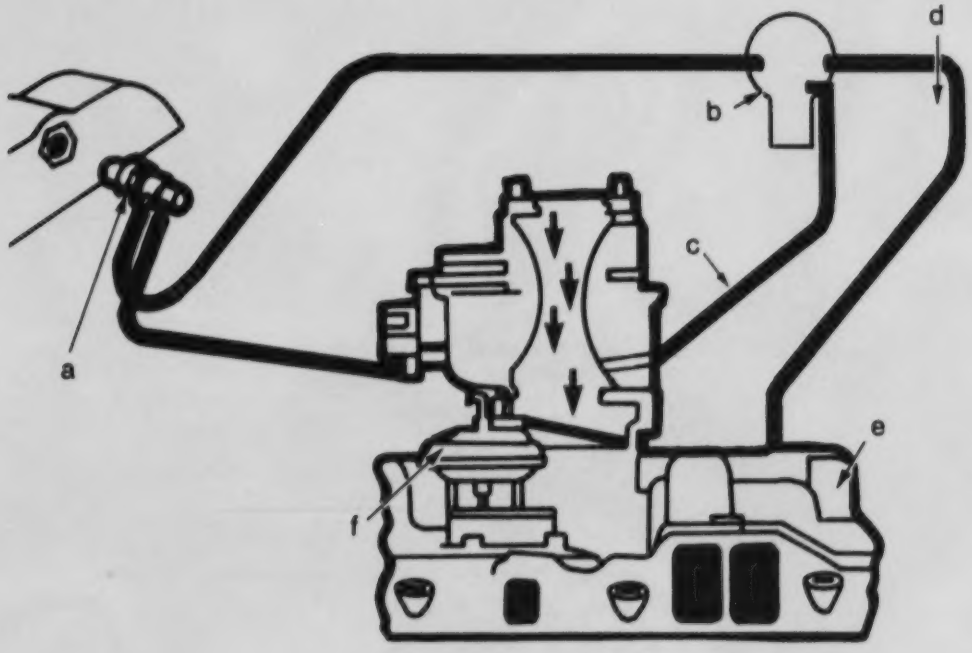


a. _____ d. _____

b. _____ e. _____

c. _____ f. _____

2. Identify the components of the venturi vacuum control exhaust gas recirculation system indicated in the diagram below.



a. _____ d. _____

b. _____ e. _____

c. _____ f. _____

3. Exhaust gas recirculation lowers _____ emissions that are formed under high temperatures and pressures.

4. The EGR valve is controlled by _____ .

5. Earlier Chrysler-made EGR systems used threaded _____ .

6. Vacuum can reach the EGR valve when the radiator top tank temperature reaches approximately:

_____ a. 60° F.
_____ b. 110° F.
_____ c. 45° F.
_____ d. 200° F.

7. The EGR valve begins to open when the coolant temperature is at correct levels and the vacuum at the carburetor reaches:

_____ a. 3–5 inches
_____ b. 5–8 inches
_____ c. 8–10 inches
_____ d. 10–12 inches

8. No exhaust gas recirculation takes place under the following engine operation conditions (check each correct answer):

_____ a. idle
_____ b. wide-open throttle
_____ c. during engine warm-up
_____ d. acceleration

9. Check each correct answer. A malfunctioning EGR system may cause an engine to:

_____ a. idle rough
_____ b. start hard
_____ c. stall, hesitate, or surge
_____ d. miss and skip

Now turn to the back of this book and check your answers for Exercise 10.

EXERCISE 11

1. Check each correct answer. To inspect the floor jets of some Chrysler EGR systems, you should use:

   _____ a. vacuum gauge
   _____ b. tachometer
   _____ c. flashlight
   _____ d. long screwdriver

2. Check each correct answer. To test a vehicle's EGR system, you should use:

   _____ a. tachometer
   _____ b. vacuum gauge
   _____ c. timing light
   _____ d. thermometer

3. The EGR coolant control valve is operating properly if there is:

   _____ a. a vacuum reading when the engine is cold
   _____ b. no vacuum reading when the engine is cold

4. To test a vehicle's EGR coolant control valve, you would connect the vacuum gauge to the:

   _____ a. carburetor port hose
   _____ b. EGR valve hose
   _____ c. venturi vacuum amplifier hose
   _____ d. intake manifold hose

5. To test a vehicle's EGR valve, you would accelerate the engine quickly and look for:

   _____ a. an increase in vacuum gauge readings
   _____ b. movement of the EGR valve stem
   _____ c. an increase in tachometer readings
   _____ d. an increase in coolant temperature

6. Another way to test a vehicle's EGR valve is with an outside vacuum source. With the engine idling at normal operating temperatures, apply 3 to 8 inches of vacuum. The engine should:

   _____ a. not change in idle RPM
   _____ b. idle roughly or stop completely
   _____ c. increase in engine RPM
   _____ d. none of these

7. Complete each statement. A quick test of the operation of the venturi vacuum amplifier involves the following steps:

   a. Operate the engine at _____ speed and at _____ operating temperatures.

   b. Remove the vacuum hose at the _____ valve and connect the vacuum gauge to the _____ hose.

   c. Remove the vacuum hose from the carburetor _____ .

   d. _____ the amplifier when the vacuum reading is not within specifications.

8. Check the correct answer. To test the carburetor EGR port to be sure it is not plugged, first connect the vacuum gauge to the port. Then:

   _____ a. with the engine operating, the vacuum gauge should indicate a reading
   _____ b. there should be no reading on the vacuum gauge with the engine operating
   _____ c. there should be no reading on the vacuum gauge when the throttle is opened and closed
   _____ d. none of these

9. Check each correct answer. EGR system maintenance only consists of:

   _____ a. inspecting the jets and passages for carbon buildup
   _____ b. testing EGR valves for correct operation
   _____ c. verifying the proper vacuum signals
   _____ d. inspecting hoses and connections

Now turn to the back of this book and check your answers for Exercise 11.

EXERCISE 12

1. Clean the EGR valve with:
   _____ a. a stiff wire brush
   _____ b. a suitable solvent
   _____ c. Liquid Plumber
   _____ d. gasoline

2. Clean the EGR floor jets with:
   _____ a. a drill
   _____ b. a piece of wire
   _____ c. cleaning solvent
   _____ d. a wire brush

3. Before you can remove the stainless steel floor jets, you must first remove:
   _____ a. the carburetor
   _____ b. the intake manifold
   _____ c. the exhaust manifold
   _____ d. the EGR valve

4. Check each correct answer. When replacing EGR vacuum hoses or EGR components, it is important to:
   _____ a. mark each hose to identify it
   _____ b. mark each vacuum port to identify it
   _____ c. replace one hose at a time
   _____ d. refer to vehicle engine vacuum diagrams in your technical service manual for correct routing

5. When you check the condition of an EGR valve diaphragm, remove the valve and:

   a. Depress the _____ and plug the vacuum

   _____ .

   b. Release the _____ ; if the valve has not

   _____ in 20 seconds, the valve diaphragm is defective.

6. Clean the carburetor vacuum ports with:
   _____ a. a drill
   _____ b. a piece of wire
   _____ c. a wire brush
   _____ d. carburetor cleaner solvent

7. The EGR maintenance reminder system alerts the driver to the need for EGR inspection every:
   _____ a. 10,000 miles
   _____ b. 15,000 miles
   _____ c. 20,000 miles
   _____ d. 30,000 miles

8. Complete each statement. To reset EGR reminder counter and switch assembly, you should do the following:

   a. Slip the rubber boot up to expose the _____ .

   b. Turn the _____ one-half turn; this procedure zeroes the _____ gears and opens the _____ .

Now turn to the back of this book and check your answers for Exercise 12.

PERFORMANCE CHECKLIST—P.O. 37

Your instructor will provide a vehicle that has an EGR system. Test the system and correct any problems you find. All of the performances below must be accomplished.

Student Performances	Instructor Ratings		
	Acceptable	Not Acceptable	Omit
1. Inspects an exhaust gas recirculation (EGR) valve-controlled system.			
2. If available, inspects an exhaust gas recirculation (EGR) floor-jet system on a Chrysler-made vehicle.			
3. Tests the operation of an EGR valve-controlled system: EGR coolant control valve EGR valve EGR carburetor ports EGR venturi vacuum amplifier			
4. If available, removes and installs an EGR floor jet of a Chrysler-made vehicle.			
5. Removes and installs an EGR coolant control valve.			
6. Removes and installs an EGR valve.			
7. Removes and installs an EGR venturi vacuum amplifier.			
8. Resets an EGR maintenance reminder system of a Chrysler-made vehicle.			
9. Uses proper tools and equipment.			
10. Follows all appropriate safety precautions.			
11. Time.			

Keep a copy of this checklist for your records.

PRETEST—P.O. 38: Ignition Timing Control Systems

NAME _____

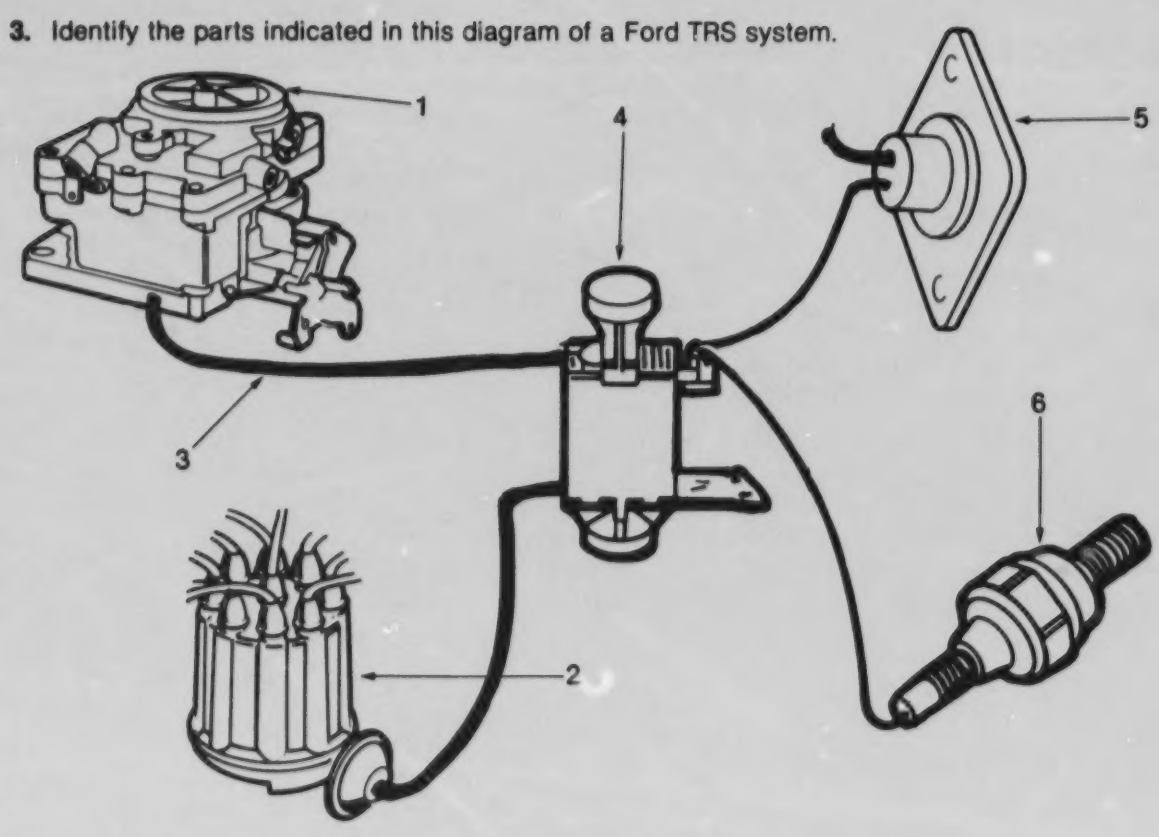
1. Most transmission control spark (TCS) systems operate by retarding ignition timing when the transmission is in:

   _____ a. low gear only
   _____ b. reverse or high gear
   _____ c. low or second gear
   _____ d. neutral or reverse gear
   _____ e. neutral or high gear

2. TCS systems alter ignition timing by:

   _____ a. changing contact point dwell
   _____ b. regulating the amount of vacuum advance
   _____ c. changing the amount of mechanical advance
   _____ d. regulating the rotation of the distributor housing

3. Identify the parts indicated in this diagram of a Ford TRS system.



Parts

_____ 1.
_____ 2.
_____ 3.
_____ 4.
_____ 5.
_____ 6.

a. electric control line
b. CEC valve
c. ambient temperature switch
d. carburetor
e. coolant temperature override switch
f. transmission switch
g. distributor modulator valve
h. vacuum line
i. distributor

4. Which component of the TRS system actually starts or stops the vacuum control signal?

_____ a. the distributor modulator valve
_____ b. the ambient temperature switch
_____ c. the transmission switch
_____ d. the coolant control valve

5. The Ford transmission regulated spark (TRS) system is energized when the outside temperature is:

_____ a. between 49° F. and 65° F.
_____ b. between 65° F. and 226° F.
_____ c. greater than 49° F.
_____ d. greater than 226° F.

60

6. When the engine coolant temperature reaches approximately 226° F., the TAC system:

_____ a. retards the engine timing
_____ b. advances the engine timing
_____ c. does not change the engine timing

7. When testing the TCS system, you should always first check the:

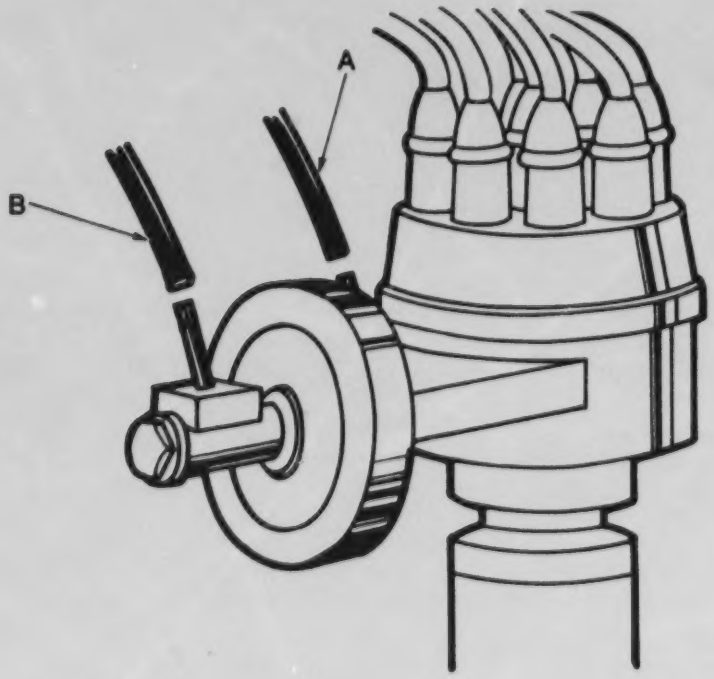
_____ a. spark plug gap
_____ b. ambient air temperature
_____ c. initial engine timing
_____ d. curb idle speed

8. If the spark advance test does not meet specifications, you should check the:

_____ a. spark retard mechanism
_____ b. distributor vacuum solenoid
_____ c. transmission switch
_____ d. distributor mechanical advance

9. The spark retard test should be made only if the:

_____ a. distributor has a dual diaphragm vacuum unit
_____ b. distributor has a single diaphragm vacuum unit
_____ c. initial timing setting was incorrect
_____ d. contact point dwell was incorrect



10. Which hose in this diagram controls vacuum retard?

_____ a. A
_____ b. B

11. During a distributor retard solenoid test, disconnecting the distributor ground lead connector should cause the timing to:

_____ a. not change from the initial setting
_____ b. retard at least five degrees from the initial setting
_____ c. advance at least five degrees from the initial setting

12. When testing the Ford TRS system, you should first make sure that:

_____ a. the temperature at the temperature switch is below 49° F.
_____ b. the engine temperature is less than 100° F.
_____ c. the temperature at the transmission switch is greater than 226° F.
_____ d. the temperature at the temperature switch is above 65° F.

13. When testing a Ford TRS system on a vehicle with manual transmission, the proper amount of vacuum to the distributor should be at least 6 inches when the:

_____ a. clutch pedal is depressed
_____ b. gear shift is set in neutral
_____ c. gear shift is set in high gear
_____ d. ambient temperature is greater than 49° F.

14. When testing a Ford TRS system on a vehicle with an automatic transmission, the proper amount of vacuum to the distributor should be zero inches when the:

_____ a. gear shift is set in reverse
_____ b. gear shift is set in neutral
_____ c. gear shift is set in high gear
_____ d. engine temperature is above 226° F.

15. What equipment is required to test the transmission switch?

_____ a. a continuity test light
_____ b. a dwell/tachometer
_____ c. an ammeter
_____ d. a timing light

16. The recommended service procedure for a defective TCS system part is to:

_____ a. repair the part
_____ b. replace the part

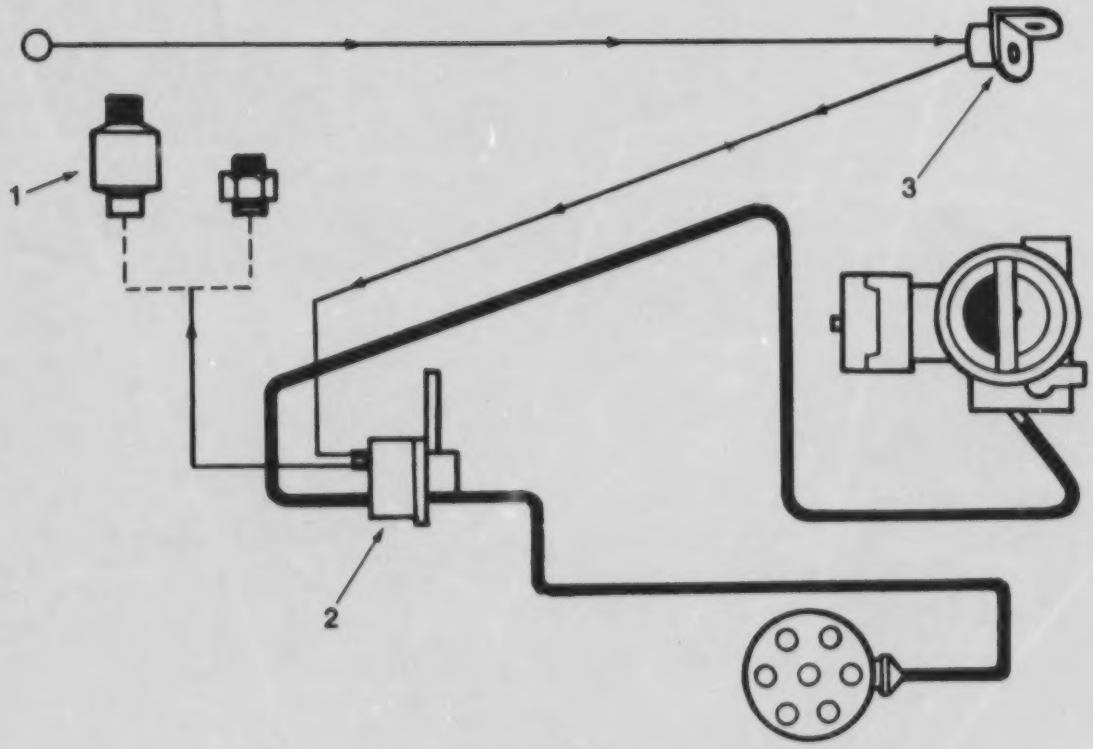
17. When testing the ambient temperature switch, a test light should go off when the temperature reaches:

_____ a. 65° F. or more
_____ b. 100° F. or more
_____ c. 65° F. or less
_____ d. 49° F. or less

18. What part of a malfunctioning TRS system could be at fault if the transmission switch, ambient temperature switch, vacuum hoses, and carburetor are functioning properly?

_____ a. the distributor modulator valve
_____ b. the ported vacuum advance
_____ c. the coolant temperature override switch
_____ d. the venturi vacuum port

19.



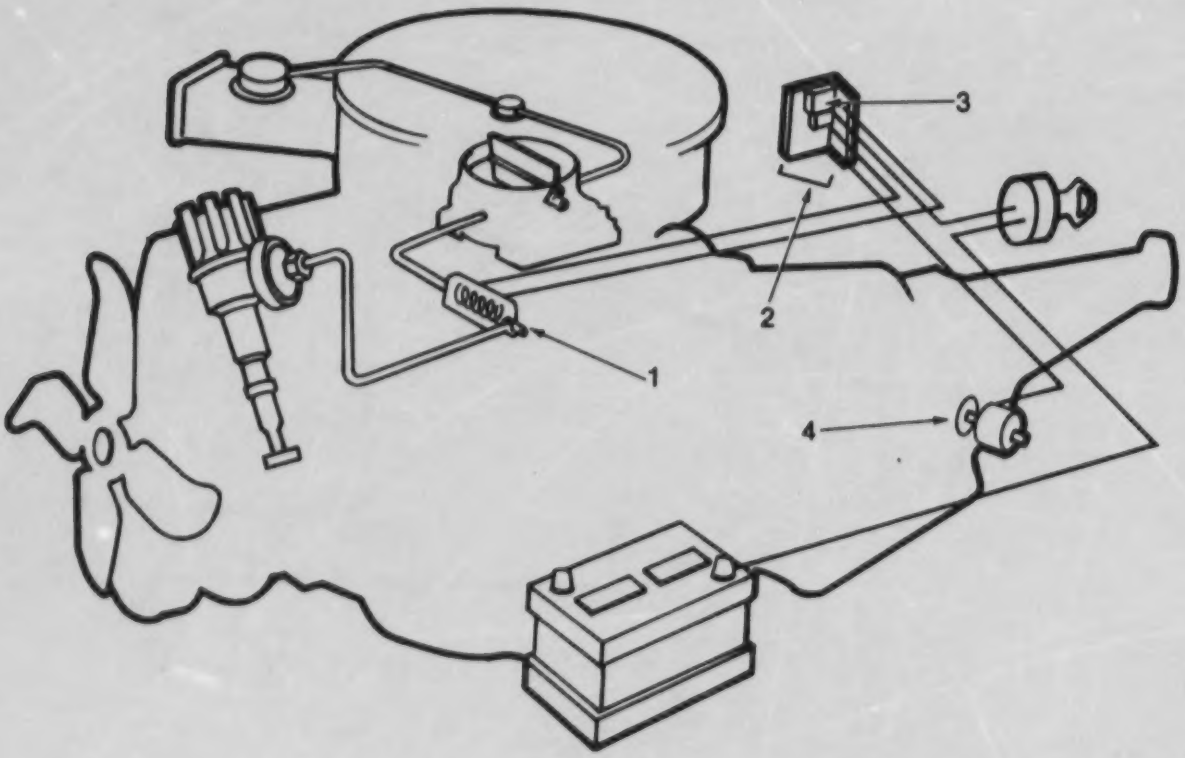
Identify the parts indicated in this diagram of an AMC TCS system.

Parts

a. combined emission control valve
b. throttle stop solenoid switch
c. ambient temperature override switch
d. transmission switch
e. distributor modulator valve
f. solenoid vacuum valve

_____ 1.
_____ 2.
_____ 3.

20. Identify the parts indicated in this diagram of a Chrysler TCS system.



Parts

_____ 1.
_____ 2.
_____ 3.
_____ 4.

a. speed switch
b. transmission switch
c. solenoid vacuum valve
d. combined emission control valve
e. control module
f. ambient temperature override switch
g. thermal switch

21. The thermo vacuum valve on a GM TCS system operates when the engine coolant temperature is:

_____ a. below 49° F.
_____ b. below 65° F.
_____ c. above 65° F.
_____ d. above 226° F.

22. What part is used in some GM TCS systems in place of a vacuum advance solenoid valve?

_____ a. a combined emission control valve
_____ b. a distributor modulator valve
_____ c. a solenoid vacuum valve
_____ d. a vacuum reducer valve

C4

23. The vacuum reducer valve on a GM TCS system operates when:

_____ a. engine vacuum is more than 6 inches
_____ b. engine coolant temperature is above 226° F.
_____ c. engine speed exceeds 2000 RPM
_____ d. the gear shift is placed in high gear range

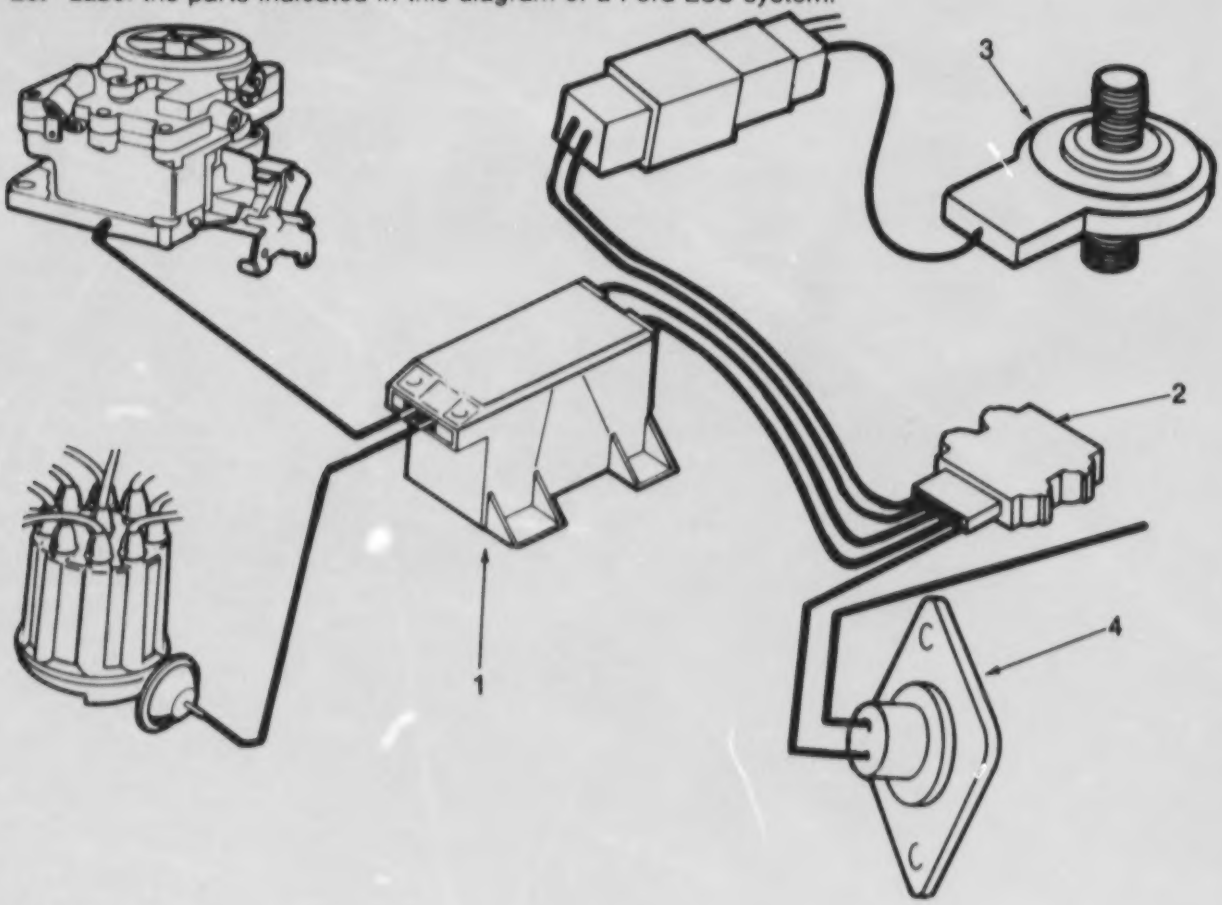
24. The electronic spark control (ESC) system regulates ignition timing as:

_____ a. engine speed changes
_____ b. transmission gear changes
_____ c. vehicle speed changes
_____ d. coolant temperature changes

25. The ESC system will not operate if the:

_____ a. engine coolant temperature is higher than 225° F.
_____ b. ambient temperature is below 49° F.
_____ c. vehicle speed is below 20 mph
_____ d. transmission is in high gear range

26. Label the parts indicated in this diagram of a Ford ESC system.



Parts

_____ 1.
_____ 2.
_____ 3.
_____ 4.

a. temperature switch
b. thermal ignition switch
c. distributor modulator valve
d. speed sensor
e. transmission switch
f. amplifier

27. Spark timing is retarded by the ESC system when:

_____ a. vehicle road speed is above 35 mph
_____ b. ambient temperature is below 49° F.
_____ c. vehicle road speed is 0 mph
_____ d. ambient temperature is above 65° F.
_____ e. none of the above answers alone is correct

28. As the engine is started during a test of the ESC system, there should be:

_____ a. no vacuum reading
_____ b. a vacuum of at least 3 inches
_____ c. a vacuum of at least 5 inches
_____ d. a vacuum of at least 6 inches

CC

29. If proper vacuum reading for an ESC system is not obtained at the cut-in speed where vacuum is present at the carburetor and the distributor modulator valve wires are disconnected, then:

_____ a. the speed sensor is faulty
_____ b. the air temperature switch is faulty
_____ c. the distributor modulator valve is faulty
_____ d. the electronic amplifier is faulty

30. What equipment is used to test the ESC temperature switch?

_____ a. a timing light
_____ b. an ohmmeter
_____ c. a continuity test light
_____ d. an ammeter

31. What part of the ESC system is at fault if all the test results are good but the system does not operate properly?

_____ a. the carburetor
_____ b. the distributor modulator valve
_____ c. the vacuum port
_____ d. the amplifier

32. The temperature activated vacuum (TAV) system does not use:

_____ a. an electronic solenoid valve
_____ b. vacuum lines
_____ c. a speed sensor
_____ d. a vacuum bleed

33. When the ambient temperature is less than 49° F., the TAV system:

_____ a. supplies vacuum from the carburetor EGR port
_____ b. supplies vacuum from the carburetor spark port
_____ c. supplies vacuum from the intake manifold
_____ d. cuts off all vacuum supply to the distributor

34. The in-line bleed of the TAV system is designed to:

_____ a. reduce excessive vacuum supply
_____ b. purge the vacuum line of excessive fuel vapors
_____ c. reduce the amount of exhaust gases routed to the carburetor
_____ d. purge the vacuum line of excessive air pressure

35. The vacuum switching mechanism in the TAV system is the:

_____ a. speed sensor
_____ b. in-line bleed
_____ c. amplifier
_____ d. three-way solenoid
_____ e. ambient vacuum supply

36. During a test of the TAV, the specified vacuum reading at an engine speed of 1500 RPM with no hoses disconnected is:

_____ a. 0 inches
_____ b. 3 inches
_____ c. 5 inches
_____ d. 15 inches

37. During a test of the TAV, the specified vacuum reading, at engine idle speed with an air temperature of 65° F. and no hoses disconnected, is:

_____ a. 0 inches
_____ b. 3 inches
_____ c. 5 inches
_____ d. 15 inches

38. One important difference between the cold temperature activated vacuum (CTAV) system and the TAV system is:

_____ a. the systems are produced by different manufacturers
_____ b. only the CTAV uses no temperature switch
_____ c. only the TAV operation is affected by vehicle speed
_____ d. only the CTAV does not restore full vacuum advance once it has been energized

39. The part of the CTAV system that maintains the flow of vacuum from the carburetor EGR port to the distributor is the:

_____ a. three-way solenoid valve
_____ b. latching relay
_____ c. in-line vacuum bleed
_____ d. temperature switch

40. When testing the CTAV system, how much vacuum should be present at an engine speed of 3000 RPM with no wires disconnected?

_____ a. 0 inches
_____ b. 3 inches
_____ c. 5 inches
_____ d. 9 inches

41. What equipment is recommended for testing the components of the CTAV electrical system?

_____ a. a continuity test light
_____ b. an ammeter
_____ c. an ohmmeter
_____ d. a dwell meter

42. The Chrysler orifice spark advance control (OSAC) system controls vacuum supply to the distributor as what is changed?

_____ a. transmission gear
_____ b. ambient air temperature
_____ c. throttle position
_____ d. transmission speed
_____ e. engine coolant temperature

43. The OSAC systems produced after 15 March 1973 differ from those produced before 15 March 1973 in that:

_____ a. the later systems use intake manifold vacuum instead of carburetor vacuum
_____ b. only the earlier systems had temperature sensors
_____ c. the later systems had the OSAC valve mounted on the engine firewall
_____ d. only the earlier systems had electronic amplifiers

44. When testing an OSAC valve, what should the vacuum gauge reading be if the valve is good?

_____ a. no vacuum increase
_____ b. vacuum rises to intake manifold level
_____ c. vacuum slowly rises in about 15–20 seconds
_____ d. vacuum slowly drops in about 15–20 seconds

45. The OSAC valve must be tested with the transmission:

_____ a. in low gear range
_____ b. in reverse
_____ c. in high gear range
_____ d. in neutral

46. The Chrysler thermal ignition control (TIC) system differs from the OSAC system in that:

_____ a. only the TIC system overrides vacuum control if engine temperature becomes too high
_____ b. the TIC system has no OSAC valve
_____ c. only the TIC system activates vacuum control as the engine warms up to normal operating temperature
_____ d. the TIC system regulates vacuum from the intake manifold instead of from the carburetor

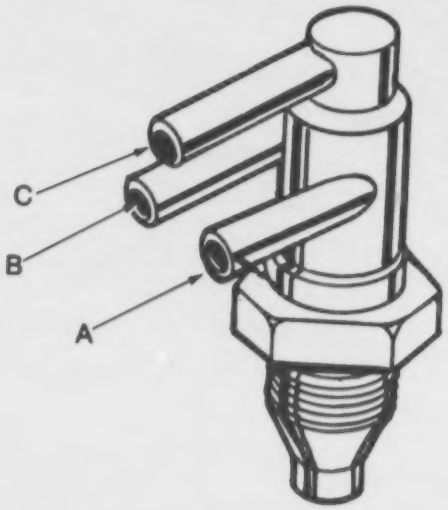
47. The TIC valve is located in:

_____ a. the vacuum line between the carburetor port and the distributor vacuum advance unit
_____ b. the intake manifold orifice
_____ c. the coolant thermostat housing
_____ d. the air cleaner cover

48. When the TIC valve is activated, the amount of vacuum advance at the distributor is:

_____ a. increased
_____ b. decreased
_____ c. not changed

49. Which port on the TIC valve pictured above is connected to the OSAC valve?



_____ a. A
_____ b. B
_____ c. C

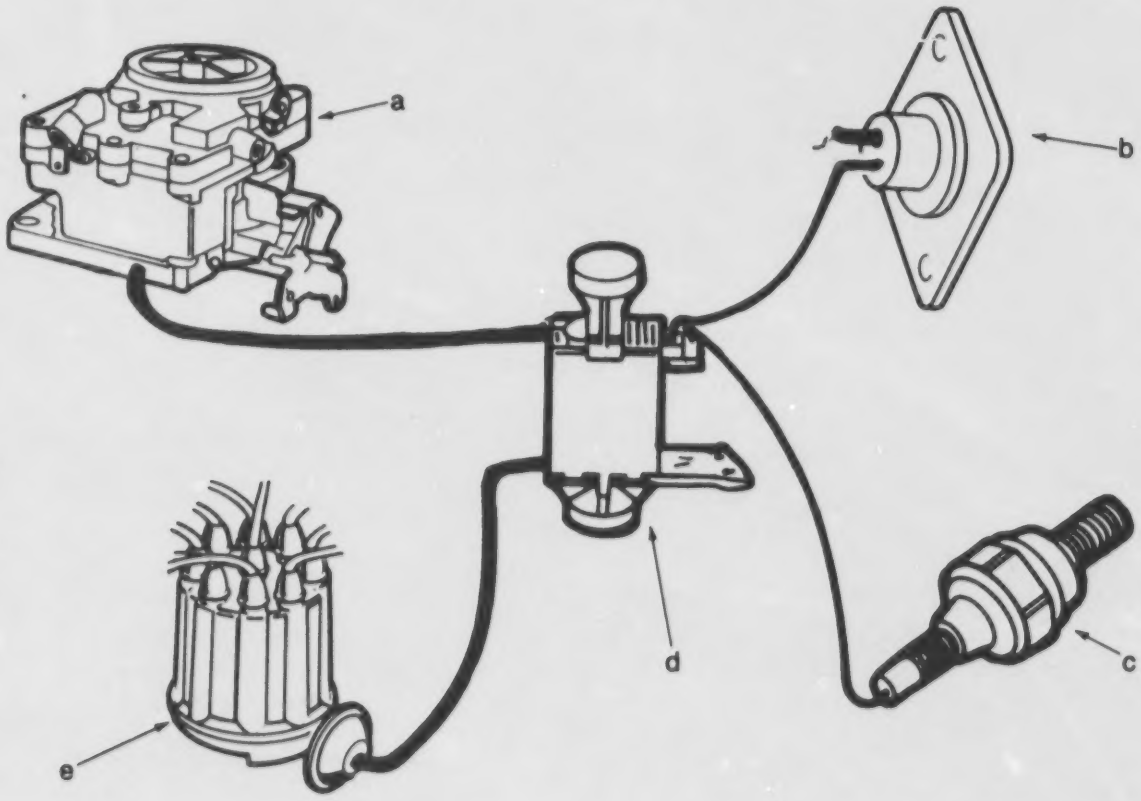
50. During a test of a properly functioning TIC valve, as engine coolant temperature reaches 225° F., engine idle speed should:

_____ a. decrease
_____ b. increase
_____ c. not change

When you finish this pretest, carefully tear it out of the book and give it to your instructor. After s(he) has checked your answers, your instructor will direct you to either practice the work activities or to study the material covered by this test.

EXERCISE 13

1. Identify each of the TCS system components indicated in the diagram below.



a. _____ d. _____

b. _____ e. _____

c. _____

2. On manual-transmission-equipped vehicles with TCS systems, vacuum advance should be allowed when the:

_____ a. transmission is in reverse
_____ b. vehicle speed is high
_____ c. transmission is in high gear
_____ d. vehicle speed is low

3. Check each correct answer. On automatic-transmission-equipped vehicles with TCS systems, vacuum advance should be allowed when the:

_____ a. transmission is in reverse
_____ b. vehicle speed is high
_____ c. transmission is in high range
_____ d. vehicle speed is low

4. The ambient temperature switch of the TCS system should operate at:

_____ a. high engine temperatures
_____ b. low engine temperatures
_____ c. high air temperatures
_____ d. low air temperatures

5. Check each correct answer. The function of the TCS system is to:

_____ a. allow distributor vacuum advance in low gear operations
_____ b. shut off distributor vacuum advance in high gear operations
_____ c. shut off distributor vacuum advance in low gear operations
_____ d. allow distributor vacuum advance in high gear operations

6. Check each correct answer. Ford's transmission regulated spark (TRS) system consists of the following components:

_____ a. distributor modulator valve
_____ b. time relay solenoid
_____ c. transmission switch
_____ d. vacuum advance solenoid valve
_____ e. temperature switch

7. The Ford TRS ambient temperature switch will open and allow normal vacuum advance in all gears at temperatures below:

_____ a. 98° F.
_____ b. 49° F.
_____ c. 30° F.
_____ d. 15° F.

8. Circle the correct answer. During low gear operation, Ford's TRS system performs the following functions:

a. temperature switch (32° F.): ***opens*** or ***closes***?
b. transmission switch: ***opens*** or ***closes***?
c. distributor modulator valve: ***energizes*** or ***de-energizes***?
d. vacuum advance allowed: ***yes*** or ***no***?

9. Circle the correct answer. During high gear operation, Ford's TRS system performs the following functions:

a. temperature switch (65° F.): ***opens*** or ***closes***?
b. transmission switch: ***opens*** or ***closes***?
c. distributor modulator valve: ***energizes*** or ***de-energizes***?
d. vacuum advance allowed: ***yes*** or ***no***?

10. Check each correct answer. A coolant temperature override (CTO) switch:

_____ a. retards timing when the engine coolant temperature reaches 226° F.
_____ b. advances timing when the engine coolant temperature reaches 226° F.
_____ c. measures engine coolant temperatures more accurately
_____ d. takes the place of the TCS temperature switch

Now turn to the back of this book and check your answers for Exercise 13.

EXERCISE 14

1. Check each correct answer. The test instruments needed to test engine initial, advance, and retard timing conditions are:

   _____ a. dwell/tachometer
   _____ b. timing light
   _____ c. vacuum gauge
   _____ d. volt/ammeter tester

2. Complete each statement. When you perform a spark advance test, you should do the following:

   a. Accelerate the engine to _____ RPM.
   b. Adjust the timing light control until the timing marks are aligned to the _____ _____ timing setting.
   c. Be sure the total spark advance readings agree with those specified by the _____ .
   d. Be sure the total spark advance readings include the _____ spark advance and the _____ spark advance.

3. Complete each statement. To do a spark retard test on an engine that has a dual diaphragm vacuum unit on the distributor, you should do the following:

   a. Disconnect the distributor _____ and plug them.
   b. With the engine idling, look at the _____ and, at the same time, connect the _____ hose to the _____ _____ vacuum chamber.
   c. The timing should _____ from the initial timing setting by the number of degrees specified.

4. Complete each statement. To do a spark retard test on an engine that has a retard solenoid on the distributor, you should do the following:

   a. Disconnect and plug the distributor _____ .

   b. After step a, with the engine idling, look at the _____ and, at the same time, disconnect the distributor _____ .

   c. After step b, the timing should _____ at least _____ degrees from the initial timing setting, and engine speed should _____ .

   d. After step c, reconnect the distributor ground lead connector while looking at the _____ .

   e. After step d, the timing should _____ to the initial timing setting.

5. Check each correct answer. Distributor timing malfunctions should be corrected:

   _____ a. before testing the TCS system
   _____ b. during the testing of the TCS system
   _____ c. after testing the TCS system
   _____ d. before adjusting contact point dwell

Now turn to the back of this book and check your answers for Exercise 14.

EXERCISE 15

1. When you test the operation of the Ford TRS system, the engine must be warmed to

   _____ operating temperatures and the air temperature switch

   must be above _____ ° F.

2. The Ford TRS system test is performed with a/an:

   _____ a. tachometer and timing light
   _____ b. vacuum gauge and tachometer
   _____ c. ohmmeter and voltmeter
   _____ d. vacuum gauge and timing light

3. On a Ford TRS system test, the vacuum gauge indicates a reading when the engine is operating and the transmission shifted into reverse. The vacuum gauge reading means that:

   _____ a. the TRS system is functioning properly
   _____ b. the transmission should be shifted into high range
   _____ c. the TRS system is not functioning properly
   _____ d. the TRS system components need to be tested

4. During the testing of the Ford transmission regulated spark (TRS) system components, each component must be tested in proper sequence. Which of the components below is out of order in the sequence given?

   _____ a. distributor modulator valve
   _____ b. transmission switch
   _____ c. temperature switch

5. The transmission switch is tested with a/an:

   _____ a. ohmmeter
   _____ b. voltmeter
   _____ c. continuity light
   _____ d. tachometer

6. The temperature switch is tested with a/an:

   _____ a. ohmmeter
   _____ b. voltmeter
   _____ c. continuity light
   _____ d. tachometer

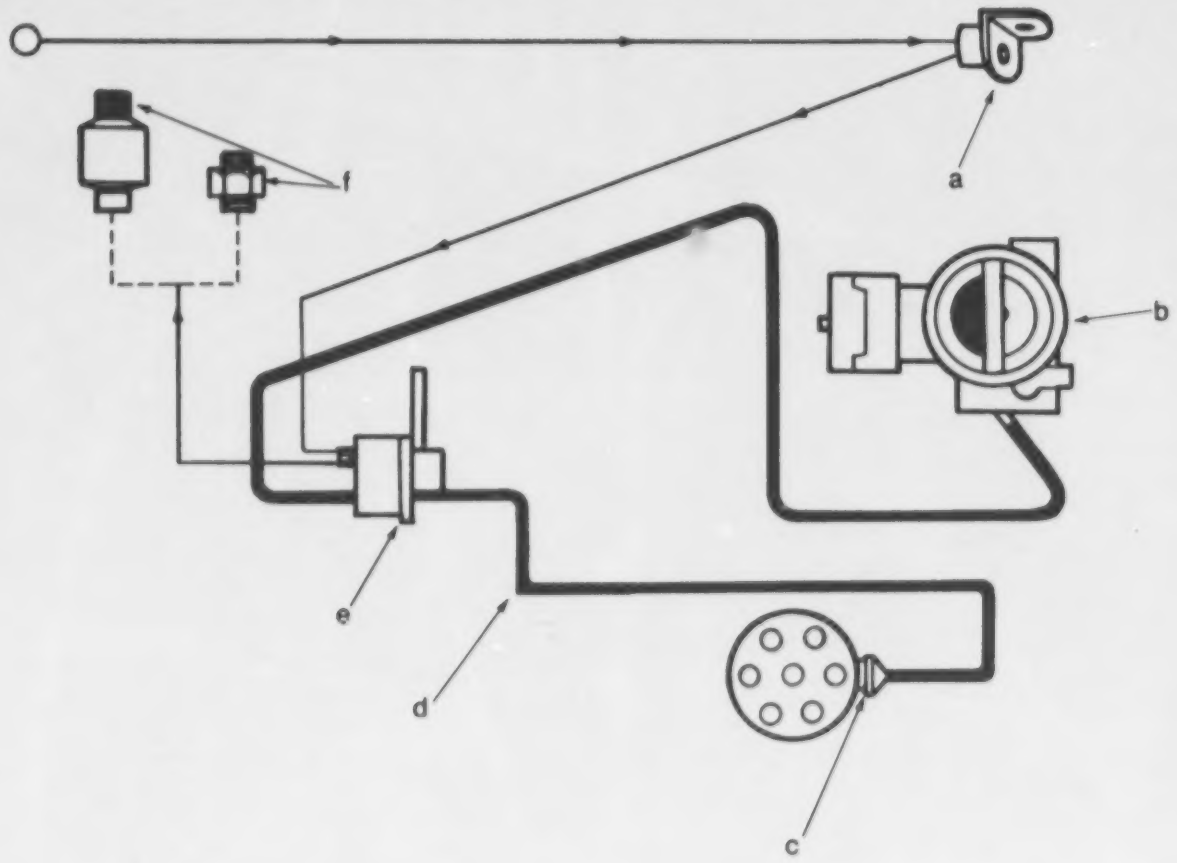
7. Check each correct answer. If both the transmission switch and the temperature switch are good, but the TRS system fails to function properly, the fault could be:

   _____ a. a faulty distributor modulator valve
   _____ b. pinched or plugged vacuum hoses
   _____ c. no venturi vacuum from the carburetor
   _____ d. a loosely connected vacuum hose

8. Check the correct answer. Maintenance is not required for any component in the transmission controlled spark system.

   _____ a. true
   _____ b. false

9. Identify the components indicated in the diagram of the American Motors TCS system below:

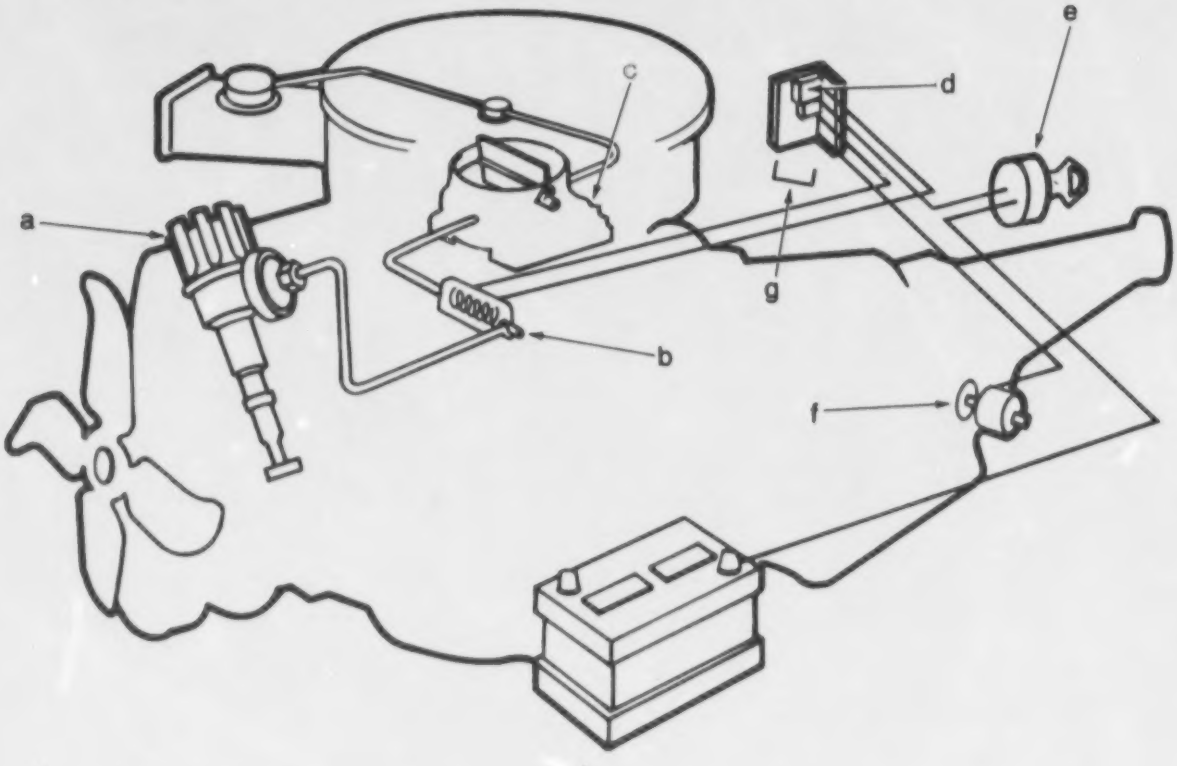


a. _____ d. _____

b. _____ e. _____

c. _____ f. _____ _____

10. Identify the components indicated in the diagram of the Chrysler TCS system below:



a. _____ d. _____

b. _____ e. _____

c. _____ f. _____

g. _____

11. In addition to a vacuum solenoid valve, temperature switch, and transmission switch, the General Motors TCS system includes:

a. _____

b. _____

12. Other TCS control valves found on GM engines include:

a. _____

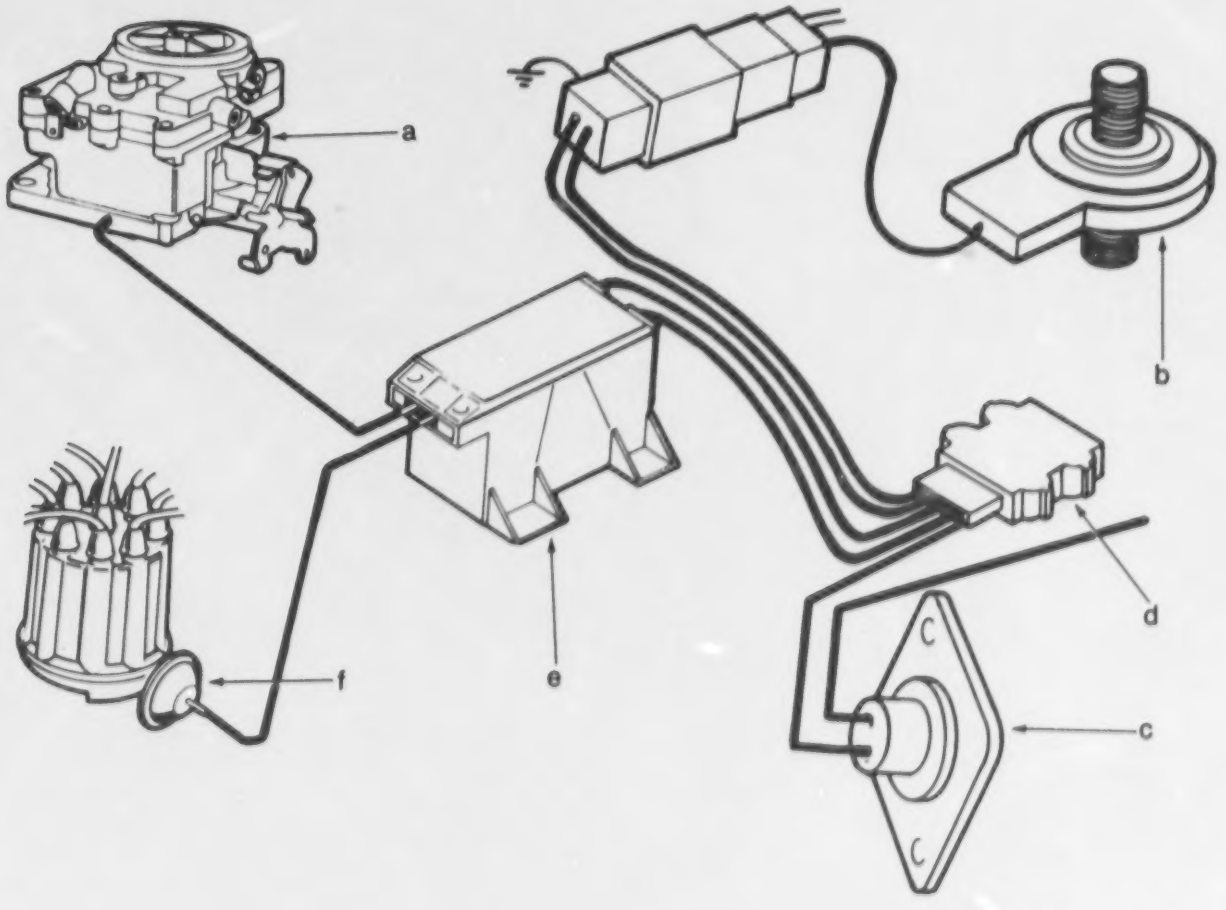
b. _____

c. _____

Now turn to the back of this book and check your answers for Exercise 15.

EXERCISE 16

1. Identify each of the components indicated in the diagram of the Ford electronic spark control (ESC) system below:



a. _____ d. _____

b. _____ e. _____

c. _____ f. _____

2. Check each correct system. The function of the ESC system is to:

_____ a. retard ignition timing (vacuum advance) when the vehicle's speed is between 0 and 35 mph
_____ b. retard ignition timing (vacuum advance) when the air temperature is above 65° F.
_____ c. restore vacuum advance when the vehicle's speed is over 35 mph
_____ d. provide vacuum advance, regardless of vehicle speeds, when the air temperature is below 49° F.

3. Check each correct answer. Ford's electronic spark control system consists of the following components:

_____ a. distributor modulator valve
_____ b. transmission switch
_____ c. temperature switch
_____ d. amplifier
_____ e. speed sensor
_____ f. timer

4. The Ford ESC temperature switch will open and allow normal vacuum advance at temperatures below:

_____ a. 98° F.
_____ b. 49° F.
_____ c. 30° F.
_____ d. 15° F.

5. When the temperature is above 65° F., the Ford ESC system will retard the ignition timing (vacuum) at road speeds between:

_____ a. 0 and 35 mph
_____ b. 0 and 30 mph
_____ c. 0 and 40 mph
_____ d. 0 and 50 mph

6. When the temperature is above 65° F., the Ford ESC system will restore vacuum advance at road speeds above:

_____ a. 30 mph
_____ b. 35 mph
_____ c. 40 mph
_____ d. 45 mph

Now turn to the back of this book and check your answers for Exercise 16.

EXERCISE 17

1. Check each correct answer. You should check the electronic spark control (ESC) system when any of these conditions occur:

   _____ a. engine runs roughly
   _____ b. engine pings
   _____ c. increase in fuel consumption
   _____ d. increase in oil consumption
   _____ e. engine starts hard

2. Check each correct answer. The first step before testing the operation of an ESC system is to:

   _____ a. test the engine initial timing setting
   _____ b. test the engine idle RPM setting
   _____ c. test the engine mechanical advance mechanism
   _____ d. test the engine vacuum advance mechanism

3. Complete each statement. To make a systems check of the Ford ESC system, you should do the following:

   a. Raise the _____ and support the vehicle with _____ .

   b. After step a, connect a _____ gauge into the vacuum hose that leads to the _____ unit.

   c. After step b, with the temperature switch at _____ ° F., start the engine and engage the _____ .

   d. After step c, the vacuum gauge should read _____ .

   e. After step d, speed up the engine to the specified vehicle cut-in _____ .

   f. After step e, the vacuum gauge should read at least _____ inches of vacuum.

4. Complete each statement. To test the operation of a temperature switch of an ESC system, you should do the following:

   a. Remove the temperature switch from the _____ .

   b. After step a, warm up the temperature switch to _____ ° F.

   c. After step b, connect a/an _____ to the switch wiring terminals.

   d. After step c, any meter reading indicates a/an _____ switch.

   e. After step d, chill the switch with ice water; a gauge reading of _____ should be indicated when the temperature switch is below _____ ° F.

5. Complete each job. To test the operation of the power supply, you should do the following:

   a. Use a/an _____ to connect one lead to ground and the other lead to the temperature switch connector.

   b. After step a, turn on the _____; the light should _____ .

6. Complete each statement. To test the operation of the speed sensor, you do the following:

   a. Connect a/an _____ to the terminals of the speed sensor.

   b. After step a, the resistance at room temperature should be _____ to _____ ohms.

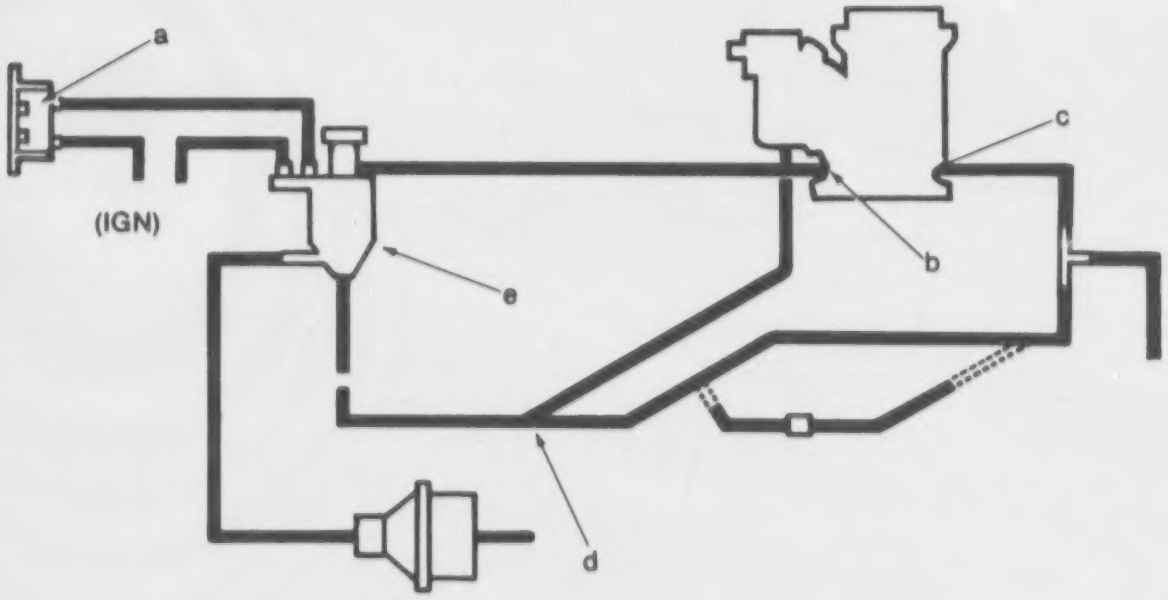
   c. After step b, the resistance between the black wire and the speed sensor _____ .

   d. After step c, there should be _____ reading.

Now turn to the back of this book and check your answers for Exercise 17.

EXERCISE 18

1. Identify each of the components indicated in the diagram of the Ford temperature activated vacuum (TAV) system below:



a. _____ d. _____

b. _____ e. _____

c. _____

2. Check each correct answer. The Ford temperature activated vacuum (TAV) system consists of the following components:

_____ a. temperature switch
_____ b. three-way solenoid valve
_____ c. in-line vacuum bleed
_____ d. distributor modulator valve
_____ e. speed sensor

3. The Ford TAV system operates by selecting vacuum from either the carbu.etor _____

_____ vacuum or the carburetor _____

_____ vacuum.

4. When the air temperature is below 49° F., the distributor vacuum advance operates from the carburetor _____ .

5. When the air temperature is above 60° F., the distributor vacuum advance operates from the carburetor _____ .

6. The in-line vacuum bleed operates to purge the vacuum line of any _____ _____ .

7. Complete each statement. To test the operation of the TAV system, you should do the following:

   a. Install a/an _____ fitting in the vacuum line to the _____ unit.

   b. After step a, attach a/an _____ gauge to the fitting.

   c. After step b, connect a/an _____ to the engine.

   d. After step c, start the engine and allow it to idle at air temperatures of at least _____ ° F.: vacuum reading should be _____ .

   e. After step d, increase engine speed to _____ RPM or slightly higher: the vacuum reading should be _____ inches or more.

   f. After step e, disconnect the EGR port vacuum line from the _____ and plug the line: at 1500 RPM, the vacuum reading should read _____ _____ .

   g. After step f, unplug the EGR port vacuum line, reconnect it, and disconnect one of the _____ from the three-way solenoid valve: at 1500 RPM, the vacuum gauge should read over _____ inches.

8. Check each correct answer. If the TAV system indicates a malfunction, it will be necessary to test the following components to find the faulty part:

_____ a. temperature switch
_____ b. three-way solenoid valve
_____ c. speed sensor
_____ d. transmission control valve

Now turn to the back of this book and check your answers for Exercise 18.

EXERCISE 19

1. Check each correct answer. The Ford cold temperature activated vacuum (CTAV) system consists of the following components:

   _____ a. speed sensor
   _____ b. temperature switch
   _____ c. transmission switch
   _____ d. latching relay
   _____ e. in-line bleed
   _____ f. three-way solenoid valve

2. The Ford CTAV system operates by selecting vacuum from either the carburetor _____ _____ vacuum or the carburetor _____ vacuum.

3. The _____ allows EGR port vacuum to reach the distributor vacuum advance at all times once the temperature switch closes (above 65° F.).

4. Once the _____ is on, it stays on until the ignition switch is turned off.

5. Complete each statement. To test the operation of the CTAV vacuum system, you should do the following:

   a. Connect a/an _____ to the hose leading to the distributor vacuum advance unit.

   b. After step a, connect a/an _____ to the engine.

   c. After step b, and with the temperature switch over _____ ° F., disconnect the _____ from the three-way solenoid valve.

   d. After step c, operate the engine at 1500 RPM: vacuum should be approximately _____ inches.

   e. After step d, reconnect the _____ : there should be _____ or _____ vacuum.

   f. After step c, operate the engine at _____ RPM: vacuum should be approximately _____ inches.

6. Complete each statement. To test the operation of the CTAV electrical system, you should do the following:

   a. Connect a/an _____ to the temperature switch terminal of the three-way solenoid vacuum valve.

   b. After step a, disconnect the wiring connector from the _____ and turn the _____ on.

   c. After step b, the test light should _____ .

   d. After step c, replace the _____ if the light goes on.

   e. After step d, reconnect the _____ to the temperature switch: the light should _____ .

   f. After step e, disconnect the _____ from the latching relay: the light should _____ .

   g. After step f, replace the _____ if the light does not go on.

   h. After step g, connect the continuity test light to the terminal of the _____ and cool the temperature switch to a temperature below _____ ° F.

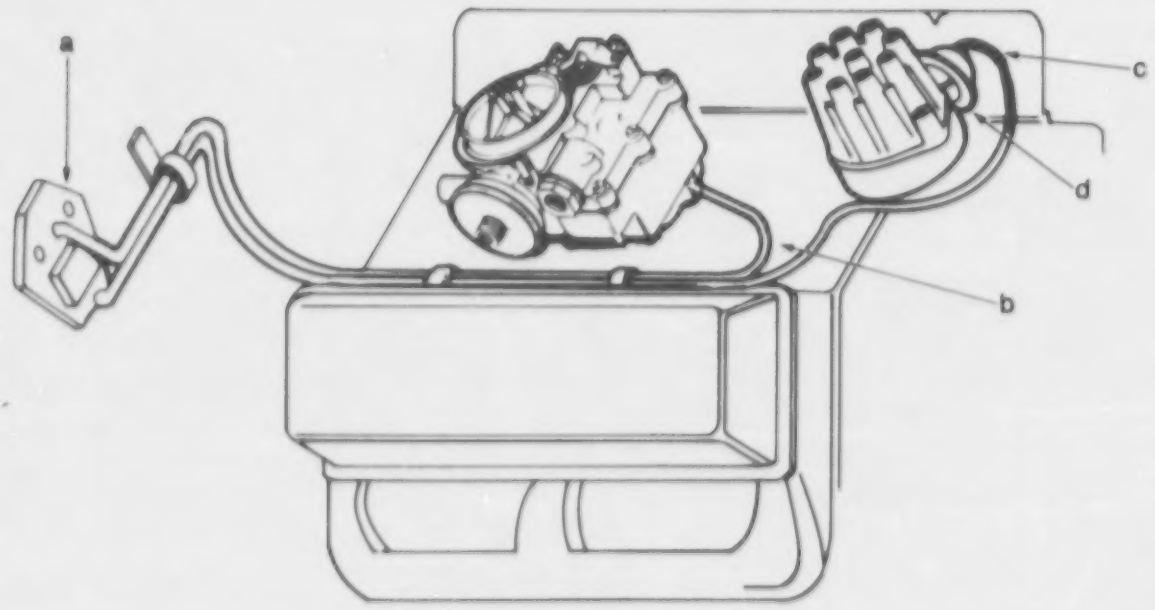
   i. After step h, the light should _____ .

   j. After step i, replace the _____ if the light stays on.

Now turn to the back of this book and check your answers for Exercise 19.

EXERCISE 20

1. Identify the parts of a Chrysler OSAC system indicated in the diagram below:



a. _____ c. _____

b. _____ d. _____

2. The purpose of the OSAC valve is to delay the change in ported vacuum to the distributor for about:

_____ a. 10 to 12 seconds
_____ b. 13 to 17 seconds
_____ c. 17 to 27 seconds
_____ d. 20 to 30 seconds

3. The OSAC valve of a 1974 Chrysler vehicle is mounted on the:

_____ a. engine fire wall
_____ b. engine coolant housing
_____ c. carburetor air cleaner
_____ d. intake manifold

4. Complete each statement. To test the operation of the OSAC system, you should do the following:

   a. Inspect all vacuum hoses for _____ or

   _____ .

   b. After step a, connect a/an _____ to the engine.

   c. After step b, and with the engine running at _____ RPM, disconnect the vacuum hose (to distributor) from the _____ .

   d. After step c, connect a/an _____ to the

   _____ valve.

5. After completing the procedures in question 4, you know that the OSAC valve is good when the vacuum increase is very gradual, reaching a stabilized level in about:

   _____ a. 5 to 10 seconds
   _____ b. 10 to 15 seconds
   _____ c. 15 to 20 seconds
   _____ d. 20 to 25 seconds

6. If the vacuum increases immediately, the OSAC valve is _____ .

7. If there is no vacuum increase, the OSAC valve is _____ .

Now turn to the back of this book and check your answers for Exercise 20.

EXERCISE 21

1. The function of the thermal ignition control (TIC) valve is to switch from carburetor vacuum to manifold vacuum when the engine coolant reaches a temperature of about:

   _____ a. 180° F.
   _____ b. 200° F.
   _____ c. 225° F.
   _____ d. 235° F.

2. Switching from carburetor vacuum to manifold vacuum causes engine speed, at idle, to:

   _____ a. increase
   _____ b. decrease

3. Complete each statement. To test the operation of the thermal ignition control valve, you should do the following:

   a. Check the vacuum hoses for proper _____ and for leaks or other _____.

   b. After step a, attach a/an _____ to the engine.

   c. After step b, bring the engine to _____ operating temperature, disconnect the distributor _____ at the carburetor, and adjust idle speed to _____ RPM.

   d. After step c, disconnect the _____ vacuum hose from the TIC valve and _____ the hose.

4. After you do the procedures in question 3, you can tell that the TIC valve is operating properly when the engine idle speed:

   _____ a. drops 100 RPM or more
   _____ b. does not change

5. Check each statement. To continue testing the operation of the TIC valve, you should do the following:

   a. Unplug the _____ vacuum hose and reconnect it to the _____.

   b. After step a, cover the _____ to increase engine coolant _____.

   c. After step b, idle the engine until the coolant temperature reaches about _____ ° F.

6. After you have done the procedures in question 5, you can tell that the TIC valve is operating properly when the engine idle speed:

_____ a. increases 100 RPM or more
_____ b. does not change

Now turn to the back of this book and check your answers for Exercise 21.

PERFORMANCE CHECKLIST—P.O. 38
TCS SYSTEM

The instructor will provide a vehicle that has a TCS system. Test the system and correct any problems you find. All of the performances below must be accomplished.

Student Performances	Instructor Ratings		
	Acceptable	Not Acceptable	Omit
1. Checks and adjusts engine initial timing.			
2. Tests distributor spark advance and compares readings with manufacturer's specifications.			
3. Tests distributor spark retard (dual diaphragm vacuum unit) and compares readings with manufacturer's specifications.			
4. Tests distributor retard solenoid operation.			
5. Tests the operation of a transmission-regulated spark system on a Ford vehicle.			
6. Raises the rear of the vehicle from the floor, and supports it.			
7. Tests each transmission control spark system component (transmission switch and temperature switch of a Ford TRS system).			
8. Corrects any problems found.			
9. Uses vacuum pressure gauge.			
10. Lowers vehicle safely to floor.			
11. Follows all appropriate safety precautions.			
12. Time.			

Keep a copy of this checklist for your records.

PERFORMANCE CHECKLIST—P.O. 38
ESC SYSTEM

Your instructor will provide a vehicle that has an electronic spark control (ESC) system. Test the system and correct any problems you find. All of the performances below must be accomplished.

Student Performances

1. Checks and adjusts engine initial timing.
2. Tests distributor spark advance and compares readings with manufacturer's specifications.
3. Tests distributor spark retard (dual diaphragm vacuum unit) and compares readings with manufacturer's specifications.
4. Tests distributor retard solenoid operation.
5. Raises the rear of the vehicle from the floor and supports it.
6. Tests the operation of the electronic spark control system of a Ford vehicle.
7. Tests each electronic spark control component (temperature switch, power supply, speed sensor) of a Ford ESC system.
8. Corrects any problems found.
9. Uses vacuum pressure gauge and ohmmeter.
10. Lowers vehicle safely to floor.
11. Follows all appropriate safety procedures.
12. Time.

Instructor Ratings

Acceptable	Not Acceptable	Omit

PERFORMANCE CHECKLIST—P.O. 38
FORD'S TAV SYSTEM

Your instructor will provide a Ford vehicle that has a temperature activated vacuum (TAV) system. Test the system and correct any problems you find. All of the performances below must be accomplished.

Student Performances	Instructor Ratings		
	Acceptable	Not Acceptable	Omit
1. Checks and adjusts engine initial timing.			
2. Tests distributor spark advance and compares readings with manufacturer's specifications.			
3. Tests distributor spark retard (dual diaphragm vacuum unit) and compares readings with manufacturer's specifications.			
4. Tests the operation of a temperature activated vacuum (TAV) system on a Ford vehicle.			
5. Corrects any problems found.			
6. Uses vacuum gauge and tachometer.			
7. Follows all appropriate safety procedures.			
8. Time			

Keep a copy of this checklist for your records.

PERFORMANCE CHECKLIST—P.O. 38
FORD'S CTAV SYSTEM

Your instructor will provide a Ford vehicle that has a cold temperature activated vacuum (CTAV) system. Test the system and correct any problems you find. All of the performances below must be accomplished.

Student Performances	Instructor Ratings		
	Acceptable	Not Acceptable	Omit
1. Checks and adjusts engine initial timing.			
2. Tests distributor spark advance and compares readings with manufacturer's specifications.			
3. Tests distributor spark retard (dual diaphragm vacuum unit) and compares readings with manufacturer's specifications.			
4. Tests the operation of the Ford cold temperature activated vacuum (CTAV) system.			
5. Tests the operation of the Ford cold temperature activated vacuum (CTAV) electrical system.			
6. Corrects any problems found.			
7. Uses vacuum gauge, tachometer, and continuity test light.			
8. Follows all appropriate safety procedures.			
9. Time.			

Keep a copy of this checklist for your records.

PERFORMANCE CHECKLIST—P.O. 38
CHRYSLER'S OSAC SYSTEM

Your instructor will provide a Chrysler vehicle that has an orifice spark advance control (OSAC) system. Test the system and correct any problems you find. All of the performances below must be accomplished.

Student Performances	Instructor Ratings		
	Acceptable	Not Acceptable	Omit
1. Checks and adjusts engine initial timing.			
2. Tests distributor spark advance and compares readings with manufacturer's specifications.			
3. Tests distributor retard solenoid operation.			
4. Tests the operation of the orifice spark advance control system on a Chrysler-made vehicle.			
5. Corrects any problems found.			
6. Uses vacuum pressure gauge and tachometer.			
7. Follows all appropriate safety precautions.			
8. Time.			

Keep a copy of this checklist for your records.

PERFORMANCE CHECKLIST—P.O. 38
CHRYSLER'S TIC VALVE

Your instructor will provide a Chrysler vehicle that has a thermal ignition control (TIC) valve. Test the valve and correct any problems you find. All of the performances below must be accomplished.

Student Performances	Instructor Ratings		
	Acceptable	Not Acceptable	Omit
1. Tests the operation of the thermal ignition control (TIC) valve.			
2. Corrects any problems found.			
3. Uses tachometer.			
4. Follows all appropriate safety precautions.			
5. Time.			

Keep a copy of this checklist for your records.

PRETEST—P.O. 39: HC-CO TESTER

Name _____

1. The exhaust emission tester (HC–CO tester) measures:

   _____ a. fluorocarbons and water emissions
   _____ b. hydrocarbons and carbon monoxide emissions
   _____ c. carbon monoxide and chlorine emissions
   _____ d. amount of gasoline residue in the tail pipe

2. The HC–CO tester has _____ gauges for measuring exhaust emissions:

   _____ a. 1
   _____ b. 2
   _____ c. 3
   _____ d. none

3. If an automobile is properly tuned, the HC level should be under _____ parts per million (ppm):

   _____ a. 800
   _____ b. 400
   _____ c. 200
   _____ d. 1000

4. When vehicles built since 1971 are properly tuned, CO readings should be below _____. For older vehicles, readings should be below _____:

   _____ a. 800 ppm, 1200 ppm
   _____ b. 200 ppm, 600 ppm
   _____ c. 2 percent, 6 percent
   _____ d. 1 percent, 3 percent

5. The steps below for adjusting the carburetor idle mixture to reach the proper HC–CO levels are out of order. Write the letter of each step in the blank beside the proper number to show the correct sequence.

Order	Steps
_____ 1.	a. Adjust the idle speed screw to manufacturer's specifications.
_____ 2.	b. Adjust the idle mixture screws equally to obtain the lowest CO reading and the smoothest idle.
_____ 3.	c. Lightly seat each idle mixture screw, and then back each screw out approximately four turns.
_____ 4.	d. Start the engine and allow the engine to reach normal operating temperatures.
_____ 5.	e. Adjust the idle mixture screws equally to obtain the lowest HC reading and the smoothest idle.

6. When you use an HC–CO tester to test the PCV system:
   _____ a. the CO reading should increase to indicate the PCV valve is working
   _____ b. the HC reading should increase to indicate the PCV valve is working.
7. When you use an HC–CO tester to test the accelerating pump:
   _____ a. the CO reading should increase to indicate that the accelerator pump is working
   _____ b. the HC reading should increase to indicate that the accelerator pump is working

When you finish this pretest, carefully tear it out of the book and give it to your instructor. After s(he) has checked your answers, your instructor will direct you to either practice the work activities or to study the material covered by this test.

EXERCISE 22

1. The exhaust emission tester is also called a/an _____ tester or a/an _____ tester.

2. Hydrocarbons are:

   _____ a. unburned gasoline
   _____ b. unburned water
   _____ c. unburned hydrogen
   _____ d. a mixture of hydrogen and carbon dioxide

3. Hydrocarbons are measured in:

   _____ a. revolutions per minute (RPM)
   _____ b. parts per million (ppm)
   _____ c. percentage
   _____ d. inch–ounces

4. For emission controlled vehicles from 1971 to the present, hydrocarbon levels should be under:

   _____ a. 100 ppm
   _____ b. 200 ppm
   _____ c. 300 ppm
   _____ d. 400 ppm

5. Check each correct answer. Carbon monoxide is:

   _____ a. a poisonous gas
   _____ b. a result of incomplete combustion
   _____ c. a partial burning of the fuel mixture
   _____ d. the same as carbon dioxide

6. Carbon monoxide is measured in:

   _____ a. ounces
   _____ b. percentage
   _____ c. parts per million
   _____ d. pounds

7. For emission-controlled vehicles from 1971 to the present, carbon monoxide levels should be under:

   _____ a. 1 percent
   _____ b. 2 percent
   _____ c. 3 percent
   _____ d. 4 percent

8. Check each correct answer. Excessively high hydrocarbon (HC) readings are caused by:

   _____ a. poor ignition
   _____ b. leaky cylinder valves
   _____ c. low engine compression
   _____ d. excessively rich mixtures

100

9. Check each correct answer. Excessively high carbon monoxide (CO) readings are caused by:

_____ a. a dirty air cleaner
_____ b. a restricted or inoperative PCV system
_____ c. a carburetor rich mixture adjustment
_____ d. a stuck choke valve

Now turn to the back of this book and check your answers for Exercise 22.

EXERCISE 23

1. Final carburetor idle speed and idle mixture adjustments are done using an HC–CO tester, following all _____ corrections.

2. Complete each statement. To adjust the carburetor idle mixture in order to reach the proper HC–CO levels, you would follow these steps:

   a. Lightly _____ each idle mixture screw, and then back each screw out approximately _____ turns.

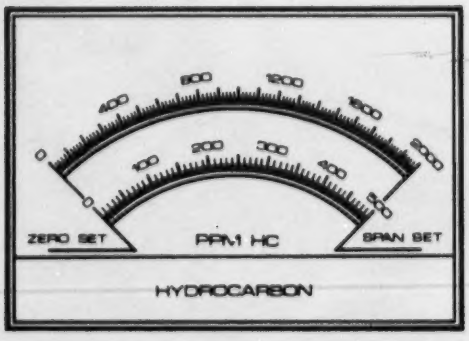
   b. After step a, start the engine and allow the engine to reach normal operating _____ .

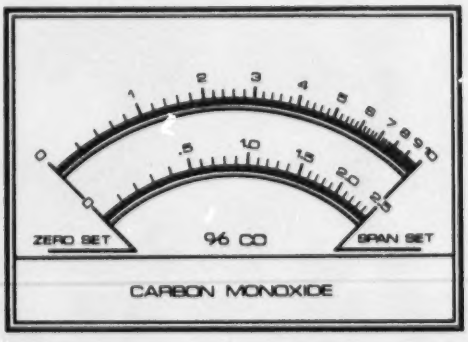
   c. After step b, adjust the idle speed screw to _____ .

   d. After step c, adjust the idle mixture screws _____ to obtain the lowest _____ reading and the smoothest idle.

   e. After step d, adjust the idle mixture screws _____ to obtain the lowest _____ reading and the smoothest idle.

3. In the diagram below, draw the position of the gauge needle on the lower scale to indicate the manufacturer's maximum specifications for a 1971 or newer vehicle equipped with emission controls.





4. When you use an HC–CO tester to test the PCV system:
   _____ a. the CO reading should increase to indicate that the PCV valve is working
   _____ b. the HC reading should increase to indicate that the PCV valve is working

5. When you use an HC–CO tester to test the accelerator pump:

   _____ a. the CO reading should increase to indicate that the accelerator pump is working
   _____ b. the HC reading should increase to indicate that the accelerator pump is working

6. Complete each statement. When you use an HC–CO tester to test the air pump system, you should do the following:

   a. Operate the engine at approximately _____ RPM.

   b. After step a, and while maintaining the same engine speed, disconnect the _____ from the air pump.

   c. After step b, both HC and CO readings should _____ to indicate the air pump system is working.

7. Complete each statement. When you use an HC–CO tester to test the exhaust gas recirculation (EGR) system, you should do the following:

   a. Establish the HC-CO readings at _____ speed.

   b. After step a, stop the engine, remove the _____ valve, and plug the _____ port in the intake manifold.

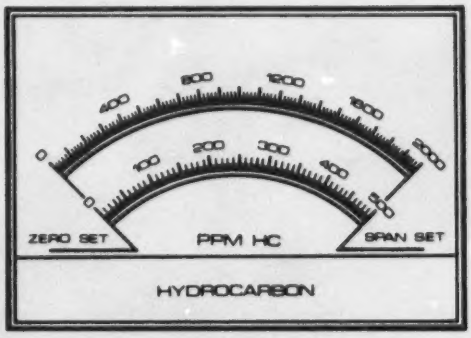
   c. After step b, start the engine, and with the engine operating at idle speed, the _____ gauge reading should remain the same.

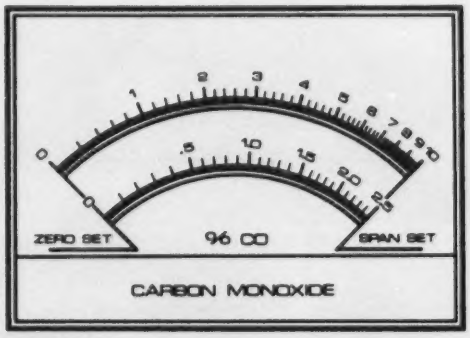
Now turn to the back of this book and check your answers for Exercise 23.

EXPERIMENTAL TEST RESULTS USING HC-CO TESTER

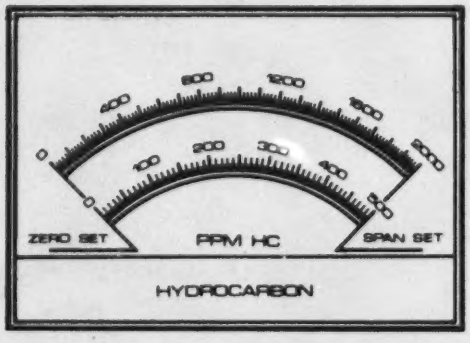
On the gauge scales below, draw in the needle readings to indicate the changes in HC-CO levels for each of the experimental tests:

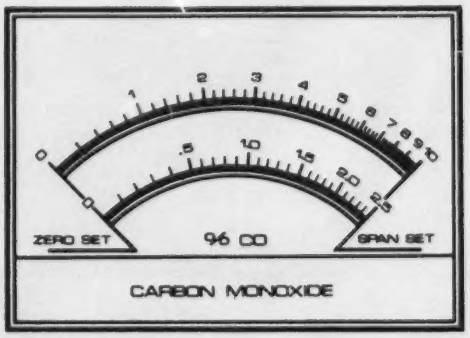
Test No. 1: Idle Mixture



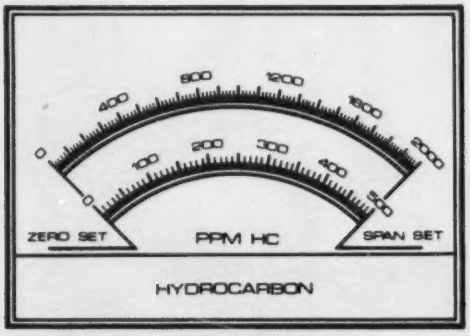


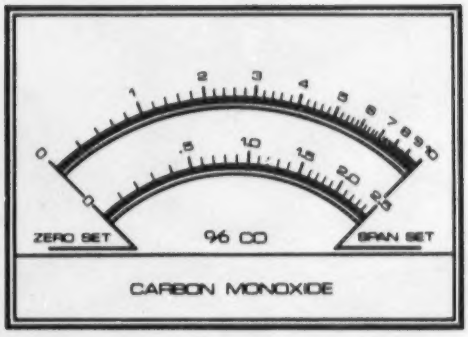
Test No. 2: Restricted Air Cleaner



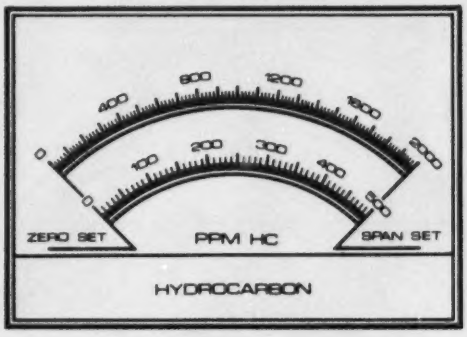


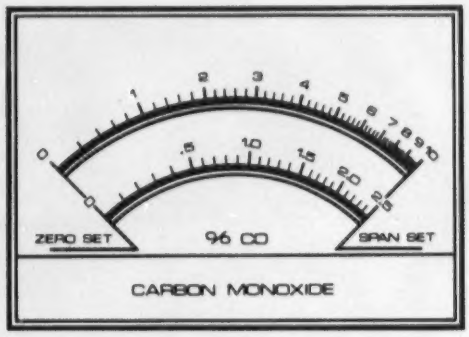
Test No. 3: Ignition Misfire



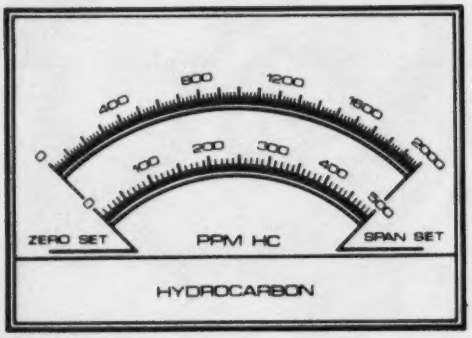


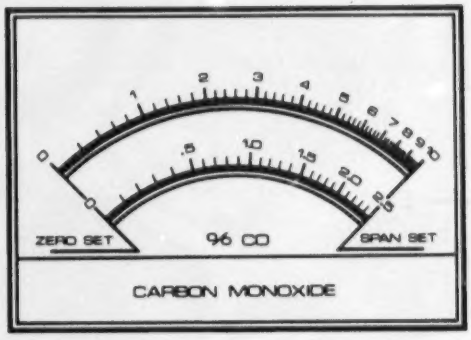
Test No. 4: Crossed Spark Plug Wire



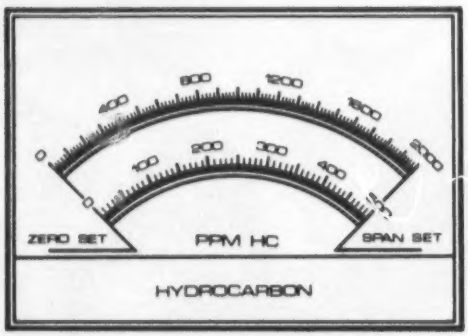


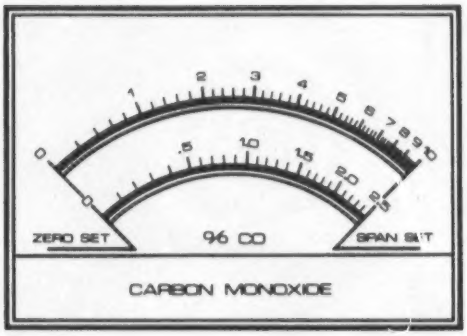
Test No. 5: Spark Plug Gap



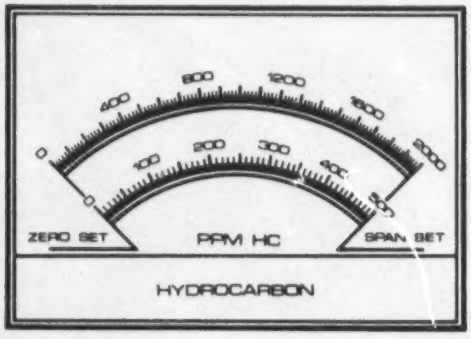


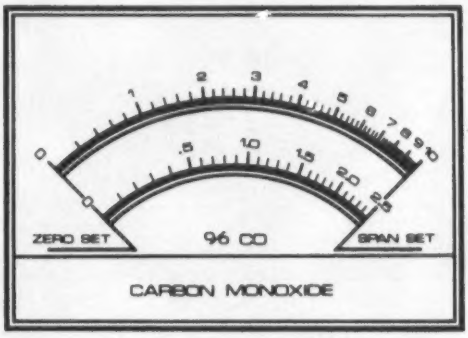
Test No. 6: Vacuum Leak





Test No. 7: EGR Valve Tests





Now return to page 203 in your Student Guide.

PERFORMANCE CHECKLIST—P.O. 39

Your instructor will provide an HC–CO tester and vehicle for this performance objective. Test the exhaust emissions on the vehicle and record your test results. All of the performances below must be accomplished.

Student Performances

1. Warms up, calibrates, and hooks up the HC–CO tester to a vehicle.
2. Tests the HC–CO levels of a vehicle and analyzes the results.
3. Uses HC–CO tester to adjust the carburetor idle mixture of a vehicle engine to specifications.
4. Performs a PCV system test.
5. Performs an accelerator pump test.
6. Performs an air pump test.
7. Performs an EGR system test.
8. Tests a restricted air cleaner.
9. Tests ignition misfire.
10. Tests crossed spark plug wires.
11. Tests the spark plug gap.
12. Tests a vacuum leak.
13. Follows all appropriate safety precautions.
14. Time.

Instructor Ratings

Acceptable		Not Acceptable		Omit

Keep a copy if this checklist for your records.

ANSWERS TO THE EXERCISES

ANSWERS TO EXERCISE 1

1. Carburetor air cleaner covers and filter elements will be crushed or damaged if not stored in a safe place.

2. a. crankcase inlet air cleaner
   b. PCV inlet hose
   c. PCV filter
   d. carburetor air cleaner
   e. PCV control valve
   f. PCV valve hose
   g. intake manifold

3. d

4. b, c, d

5. d

6. a

7. b

8. a. curb idle, operating
   b. rocker cover
   c. hissing noise
   d. valve inlet, vacuum
   e. paper, opening
   f. sucked

9. a. curb idle, operating
   b. squeeze (or clamp), stop
   c. 60

Now return to page 18 in your Student Guide.

ANSWERS TO EXERCISE 2

1. a

2. c

3. b

4. b

5. a. cleaning solvent
   b. lubricate, SAE-30 oil
   c. inlet vent
   d. rocker cover

6. a, c

Now return to page 23 in your Student Guide.

ANSWERS TO EXERCISE 3

1. Fuel vapor fumes could ignite and cause an explosion or fire.
2. Plugging fuel vapor lines will keep hazardous fumes from escaping into the air.
3. a. vapor-liquid separator
   b. vapor vent line
   c. charcoal canister
   d. purge line
   e. fuel tank
   f. pressure-vacuum filler cap
4. c
5. b, d, e
6. a, b, c
7. c
8. a
9. charcoal, vapors
10. filter
11. 12,000; 24,000; 12; 24

Now return to page 39 in your Student Guide.

ANSWERS TO EXERCISE 4

1. rubber, EVAP
2. fire, explosion
3. cover
   a. hoses, separator
   b. mounting
4. vented
5. pressure-vacuum
6. a. hoses
   b. mounting bracket
   c. cover, filter
   d. canister, lip
   e. mounting bracket

Now return to page 44 in your Student Guide.

ANSWERS TO EXERCISE 5

1. The carbon monoxide fumes might kill you.
2. The sampling hose and probe tip can become damaged if left on the shop floor where a vehicle can be driven over them.
3. 1970
4. vaporize, cold

5. a. sensor
   b. vacuum hose to intake manifold
   c. damper valve
   d. vacuum control motor
   e. snorkel tube

6. a. open
   b. 100° F., closes off

7. vacuum motor

8. 12,000; 12

9. a. vacuum hoses
   b. damper valve

10. a. stalls, accelerates
    b. pings

11. a. thermometer
    b. tee, vacuum gauge
    c. close
    d. thermometer, vacuum gauge

12. b

13. a

Now return to page 56 in your Student Guide.

ANSWERS TO EXERCISE 6

1. a, b, c, d, e

2. b

3. c

4. b

5. a.

6. sensor

7. vacuum diaphragm

8. a. air cleaner
   b. retaining clips
   c. sensor, gasket

9. a. vacuum hose
   b. diaphragm, lock, counterclockwise
   c. rod, door or heat control door

Now return to page 61 in your Student Guide.

ANSWERS TO EXERCISE 7

1. a. thermostat bulb
   b. thermostat rod
   c. valve plate
   d. exhaust manifold shroud tube
   e. vacuum hose
   f. vacuum override motor
2. c
3. a
4. c
5. a
6. c
7. a. snorkel, water, hot plate
   b. thermometer, water, 135
   c. open
8. vacuum pump
9. water, 80
10. b. vacuum motor plate, closed
    c. vacuum hose, open

Now return to page 69 in your Student Guide.

ANSWERS TO EXERCISE 8

1. a. check valve
   b. air hose
   c. diverter valve
   d. air pump
   e. air injection nozzle
   f. air manifold
   g. vacuum sensing line
2. afterburn
3. air
4. d
5. d
6. deceleration
7. a
8. air leaks
9. loose, seized
10. a. diverter valve
    b. air flow
    c. 1500, increase

11. a. vacuum sensing, vacuum
    b. muffler, air, muffler

12. check valve

13. a. air hose
    b. 1500, exhaust gas

Now return to page 86 in your Student Guide.

ANSWERS TO EXERCISE 9

1. b, c, d

2. a

3. c

4. a. 3 b. 2 c. 4 d. 1

5. a. 3 b. 2 c. 5 d. 1 e. 6 f. 4

6. a. 2 b. 3 c. 1

7. a

Now return to page 94 in your Student Guide.

ANSWERS TO EXERCISE 10

1. a. carburetor
   b. throttle valve
   c. intake manifold
   d. EGR valve
   e. ported vacuum line
   f. coolant control valve

2. a. coolant control valve
   b. amplifier
   c. venturi vacuum line
   d. intake manifold vacuum line
   e. intake manifold
   f. EGR valve

3. NOx

4. vacuum

5. floor jets

6. a

7. a

8. a, b, c

9. a, b, c

Now return to page 104 in your Student Guide.

ANSWERS TO EXERCISE 11

1. c
2. a, b
3. b
4. b
5. b
6. b
7. a. idle, normal
   b. EGR, EGR
   c. venturi port
   d. replace
8. a
9. a, b, c, d

Now return to page 115 in your Student Guide.

ANSWERS TO EXERCISE 12

1. b
2. c
3. a
4. a, b, c, d
5. a. diaphragm, inlet tube
   b. diaphragm, closed
6. d
7. b
8. a. reset screw
   b. reset screw, odometer, electrical circuit

Now return to page 124 in your Student Guide.

ANSWERS TO EXERCISE 13

1. a. carburetor
   b. temperature switch
   c. transmission switch
   d. distributor modulator valve
   e. distributor
2. c
3. a, b, c
4. c

5. c, d
6. a, c, e
7. b
8. a. opens
   b. closes
   c. de-energizes
   d. yes
9. a. closes
   b. opens
   c. de-energizes
   d. yes
10. b

Now return to page 132 in your Student Guide.

ANSWERS TO EXERCISE 14

1. a, b
2. a. 2000
   b. initial
   c. vehicle manufacturer
   d. mechanical, vacuum
3. a. vacuum hoses
   b. timing marks, intake manifold, inner
   c. retard
4. a. vacuum hose
   b. timing marks, ground lead connector
   c. advance, 5, increase
   d. timing marks
   e. retard
5. a

Now return to page 136 in your Student Guide.

ANSWERS TO EXERCISE 15

1. normal, 65
2. b
3. a
4. a
5. c
6. c
7. a, b, c, d
8. True

9. a. ambient temperature override switch
b. carburetor
c. vacuum advance unit
d. vacuum hose
e. solenoid vacuum valve
f. transmission switches

10. a. distributor
b. solenoid vacuum valve
c. carburetor
d. thermal switch
e. ignition switch
f. speed switch
g. control module

11. a. idle stop solenoid
b. 20-second time relay

12. a. thermo vacuum valve
b. thermal check and delay valve
c. vacuum reducer valve

Now return to page 146 in your Student Guide.

ANSWERS TO EXERCISE 16

1. a. carburetor
b. speed sensor
c. temperature switch
d. amplifier
e. distributor modulator valve
f. distributor vacuum advance unit

2. a, b, c, d

3. a, c, d, e

4. b

5. a

6. b

Now return to page 150 in your Student Guide.

ANSWERS TO EXERCISE 17

1. a, b, c

2. a, c, d

3. a. rear wheels, jack stands
b. vacuum, distributor vacuum advance
c. 65, transmission
d. zero
e. speed
f. 6

4. a. door post
b. 65
c. ohmmeter
d. good
e. zero, 49

5. a. continuity test light
   b. ignition switch, light

6. a. ohmmeter
   b. 40, 60
   c. case
   d. no

Now return to page 157 in your Student Guide.

ANSWERS TO EXERCISE 18

1. a. ambient temperature switch
   b. spark port
   c. EGR port
   d. in-line bleed
   e. three-way solenoid valve

2. a, b, c

3. spark port, EGR port

4. spark port

5. EGR port

6. gasoline vapors

7. a. tee, distributor vacuum advance
   b. vacuum
   c. tachometer
   d. 65, zero
   e. 1500, 5
   f. three-way solenoid valve, zero
   g. electrical leads, 6

8. a, b

Now return to page 162 in your Student Guide.

ANSWERS TO EXERCISE 19

1. b, d, e, f
2. spark port, EGR port
3. latching relay
4. latching relay
5. a. vacuum gauge
   b. tachometer
   c. 65, electrical lead
   d. 15
   e. electrical lead, no, low
   f. 3000, 9
6. a. continuity test light
   b. temperature switch, ignition switch
   c. not light
   d. latching relay
   e. wiring connector, go on
   f. wiring connector, go on
   g. latching relay
   h. temperature, 49
   i. go off
   j. temperature switch

Now return to page 168 in your Student Guide.

ANSWERS TO EXERCISE 20

1. a. OSAC valve
   b. vacuum hose from carburetor to OSAC valve
   c. vacuum hose from OSAC valve to distributor
   d. distributor vacuum advance unit
2. c
3. c
4. a. leaks, damage
   b. tachometer
   c. 2000, OSAC valve
   d. vacuum gauge, OSAC
5. c
6. defective
7. defective

Now return to page 173 in your Student Guide.

ANSWERS TO EXERCISE 21

1. c
2. a
3. a. routing, damage
   b. tachometer
   c. normal, ground lead, 600
   d. manifold, plug

4. b

5. a. manifold, TIC valve
   b. radiator, temperature
   c. 225

6. a

Now return to page 177 in your Student Guide.

ANSWERS TO EXERCISE 22

1. infrared, HC-CO

2. a

3. b

4. b

5. a, b, c

6. b

7. a

8. a, b, c, d

9. a, b, c, d

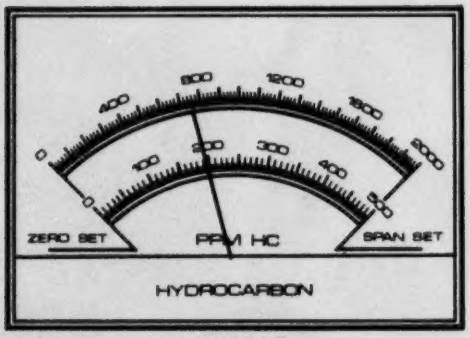
Now return to page 191 in your Student Guide.

ANSWERS TO EXERCISE 23

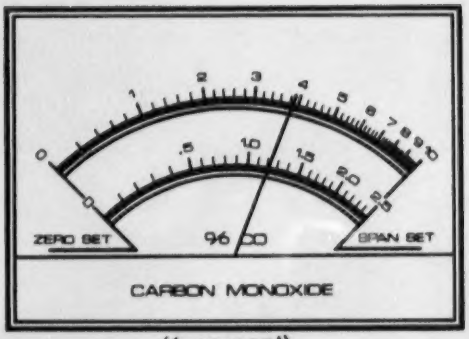
1. tune-up

2. a. seat, 4
   b. temperatures
   c. manufacturer's specifications
   d. equally, HC
   e. equally, CO

3.



(200 PPM)



(1 percent)

4. a

5. a

6. a. 1000
   b. air supply hose
   c. increase

7. a. idle
   b. EGR, vacuum supply
   c. HC

Now return to page 196 in your Student Guide. .